THE OHIO JOURNAL OF SCIENCE

VOL. XLV SEPTEMBER, 1945 No. 5

UPPER PENNSYLVANIAN AND LOWER PERMIAN ROCK SECTION AT BLAINE HILL, BELMONT COUNTY, OHIO[1]

GEORGE W. WHITE,
The Ohio State University

The relocation of the National Highway, Ohio–U. S. Route 40, in Belmont County has exposed many rock cuts in upper Pennsylvanian and lower Permian rocks from Morristown in the western part of the county to Blaine in the eastern part. These exposures have been studied as part of the investigation of the Monongahela formation by the Geological Survey of Ohio. The section exposed on the "Blaine Hill," (Fig. 1), 4 miles east of St. Clairsville, is of especial interest as it provides fresh outcrops of the upper part of the Conemaugh formation and of all of the Monongahela formation of the Pennsylvanian system and of most of the Washington formation and of the basal beds of the Greene formation of the Permian system. Its accessibility along a major highway makes a record and identification of the units of perhaps some general interest.

The section was measured by hand level in June, 1944, with the efficient aid of Mr. Richard E. Lee, field assistant during the 1944 field season. Dr. Aureal T. Cross, National Research Council Fellow, collected specimens from each of the coal units for study of micro-fossils, and his suggestions at certain points were helpful. Later in June Dr. Myron T. Sturgeon of the staff of the Geological Survey of Ohio reviewed the section with the writer, assisted in measuring a part of the Washington formation, and made extensive collections from the limestones and calcareous shales for paleontological study. Dr. Sturgeon's advice and assistance were much appreciated. Dr. Wilber Stout, Director of the Geological Survey of Ohio, has generously given counsel and suggestions based on his unrivalled knowledge of the Coal Measures in Ohio. The elevation of the Pittsburgh coal is from the records of the State Highway Testing Laboratory through the courtesy of Mr. Harry Marshall.

A section along the old National Pike west of Blaine was measured by Stauffer and Schroyer,[2] but this section was measured along the old road, where exposures were slumped and overgrown and many details and several members were concealed. The rocks did not outcrop so boldly as to excite the interest and notice of the casual traveler along the road as is now the case. The new location is much higher on the hillside as far as the horizon of the Washington coal and somewhat lower through the horizons above the Washington coal. Several hundred yards separate the outcrop of some horizons on the new location from their position along the old road, and certain differences in thickness and character of some units are to be expected in comparing the two sections. The names of the members in the section are those used by the Geological Survey of Ohio.[3]

[1]Published by permission of the Director, Geological Survey of Ohio.

[2]Stauffer, C. R., and Schroyer, C. R., "The Dunkard Series in Ohio," *Geol. Surv. Ohio Bull. 22*, pp. 48–49, 1920.

[3]Stout, W., "The Monongahela Series in Eastern Ohio," *Proc. W. Va. Acad. Science*, vol. 3, pp. 118–133, 1930.

Ibid., "Generalized Section of the Coal Bearing Rocks of Ohio," *Geol. Surv. Ohio Information Circular No. 2*, 1939.

Dr. M. T. Sturgeon, who collected samples for paleontological study in company with the writer and on other occasions, now has in preparation a report on his investigations of the approximately 70 limestone and calcareous shale units of the section. He informs the writer[4] that most of the strata so far studied are fossiliferous. He reports that ostracods, gastropods, and annelid worm tubes (*Spirorbus*) are the most abundant, but that fish remains and rare pelecypods are also present.

FIG. 1. Map of Ohio showing location of Belmont County and of Blaine Hill.

The rock section starts at road level at the bottom of the west side of the most westerly post on the south side of the viaduct at Blaine, in central-north Section 15, Pultney Township, Belmont County, and extends westward across the northwestern part of Section 15, and across the northeastern part of Section 21, Richland Township, to the sharp turn at the top of the ridge in southwestern Section 22 of the latter township. Comments on certain units are given after the section which follows by reference to the appropriate number.

[4]Sturgeon, M. T., personal communication, June 11, 1945.

ROCK SECTION AT BLAINE HILL, BELMONT COUNTY

PERMIAN SYSTEM—DUNKARD SERIES			Thickness		Interval from base of Pittsburgh	
GREENE FORMATION			Ft.	In.	Ft.	In.
163. Shale, siliceous			1	0	470	3
162. Coal, weathered, fair to good, *Jollytown "A,"* elevation 1,290± ft			0	5	469	10
WASHINGTON FORMATION						
161. Shale, gray, calcareous			0	8	469	2
160. Limestone, gray; weathers to irregular fragments	*Upper Washington*		2	6	466	8
159. Limestone, weathered; or shale, very calcareous			6	11	459	9
158. Shale, sandy, somewhat calcareous			2	7	457	2
157. Limestone, shaly, impure			3	0	454	2
156. Shale, calcareous			2	2	452	0
155. Sandstone, medium-grained, micaceous, massive, ripple marked; exposed as extensive surface north of pavement at curve at Pullman's restaurant, *Hundred*			6	0	446	0
154. Covered; along slope up National Road to crest of hill			27	3	418	9
153. Limestone, weathered, irregular	*Middle Washington*		10	0	408	9
152. Sandstone, buffish green, micaceous, calcareous, fine to medium-grained			1	9	407	0
151. Limestone, gray, nodular			0	5	406	7
150. Shale, calcareous			1	10	404	9
149. Limestone, gray, nodular			0	8	404	1
148. Sandstone, greenish gray, micaceous, calcareous, massive to irregular			6	4	397	9
147. Sandstone, very irregular, shaly			3	0	394	9
146. Shale, siliceous			2	5	392	4
145. Shale, gray, calcareous			1	0	391	4
144. Limestone, shaly to marly, ferruginous, weathers rose pink, *Creston* horizon			2	1	389	3
143. Limestone, blue-gray, shaly; and shale, calcareous			5	10	383	5
142. Limestone, gray, marly			3	0	380	5
141. Limestone, weathered			7	8	372	9
140. Covered (*Lower Washington* limestone horizon)			35	2	337	7
139. Sandstone, thin-bedded	*Lower Marietta*		5	0	332	7
138. Sandstone and covered			10	7	322	0
137. Coal blossom, *Washington*			3	6	318	6
136. Covered			4	6	314	0
135. Shale, calcareous; and limestone, nodular			5	6	308	6
134. Limestone, weathered tan			5	8	302	10
133. Shale, sandy, irregular			1	9	301	1
132. Sandstone, shaly to thin-bedded; part cross-bedded			7	2	293	11
131. Shale, sandy; with ore nodules			3	4	290	7
130. Sandstone, shaly			1	0	289	7
129. Shale, sandy; with ore nodules			1	3	288	4
128. Shale, clayey to siliceous; with ore nodules			2	4	286	0
127. Ore, irregular, weathered			0	3	285	9
126. Clay shale, gray, micaceous			1	3	284	6

			Ft.	In.	Ft.	In.
125.	Siderite, blue-gray, dense; single layer		0	3	284	3
124.	Clay shale, gray		2	4	281	11
123.	Clay shale, with carbonaceous streaks		0	2	281	9
122.	Clay shale, gray, irregular fracture		1	2	280	7
121.	Shale, coally below to carbonaceous above	*Waynesburg "A"*	0	10	279	9
120.	Limestone, dark; with carbonaceous streaks	*Waynesburg "A"*	0	2	279	7
119.	Clay shale, gray	*Waynesburg "A"*	0	3	279	4
118.	Shale, coally	*Waynesburg "A"*	0	4	279	0
117.	Limestone, blue-gray, dense, very hard; in several beds	*Mt. Morris*	2	10	276	2
116.	Shale, siliceous to sandy; with ore knots	*Mt. Morris*	5	10	270	4
115.	Limestone, gray, dense, hard	*Mt. Morris*	0	4	270	0
114.	Shale, with ore knots	*Mt. Morris*	1	7	268	5
113.	Sandstone, massive		2	5	266	0
112.	Shale, silty		1	2	264	10
111.	Sandstone, coarse; in two beds		1	9	263	1
110.	Shale, siliceous, fine-grained		7	4	255	9
109.	Clay shale, carbonaceous		0	3	255	6
108.	Limestone, thin-bedded to shaly		0	7	254	11
107.	Limestone, blue-gray, dense, hard		1	2	253	9
106.	Shale, siliceous to sandy		1	10	251	11
105.	Clay shale, gray		4	0	247	11
104.	Clay shale, carbonaceous		1	0	246	11
103.	Limestone, gray-blue, hard, shaly	*Elm Grove*	1	5	245	6
102.	Shale, gray-blue, calcareous	*Elm Grove*	0	9	244	9
101.	Limestone, gray, dense, microcrystalline, fossiliferous; lower ½" is bone bed with fish teeth	*Elm Grove*	1	10	242	11
100.	Clay shale, with thin carbonaceous streaks	*Cassville*	1	0	241	11
99.	Shale, carbonaceous	*Cassville*	0	5	241	6
98.	Clay shale, gray	*Cassville*	0	5	241	1
97.	Clay shale, carbonaceous	*Cassville*	0	2	240	11
96.	Clay shale, gray, irregular fracture	*Cassville*	0	5	240	6

PENNSYLVANIAN SYSTEM

MONONGAHELA FORMATION

95.	Shale, bony to coally	*Waynesburg*	0	3	240	3
94.	Coal, blocky, banded	*Waynesburg*	1	7	238	8
93.	Shale, dark, carbonaceous	*Waynesburg*	0	¼	238	7¾
92.	Coal, blocky, banded	*Waynesburg*	1	6	237	1¾
91.	Shale, carbonaceous	*Waynesburg*	0	¼	237	1½
90.	Coal, bright	*Waynesburg*	0	2½	236	11
89.	Clay shale, somewhat carbonaceous		0	2	236	9
88.	Clay, very impure		2	0	234	9
87.	Shale, siliceous to sandy		4	5	230	4
86.	Sandstone, shaly; with shale streaks; contains a few ore knots	*Gilboy*	3	4	227	0
85.	Shale, sandy	*Gilboy*	13	5	213	7
84.	Sandstone, fine-grained, shaly	*Gilboy*	1	9	211	10
83.	Shale, blue-gray, silty to siliceous		11	6	200	4

		Ft.	In.	Ft.	In.
82. Coal, bony, grading upward to bone shale	*Uniontown*	1	2	199	2
81. Coal, blocky		0	3	198	11
80. Shale, carbonaceous		0	2	198	9
79. Limestone, tannish gray; with thin carbon shreds		0	4	198	5
78. Shale, black, very hard, carbonaceous, calcareous, (black-band?)		0	5	198	0
77. Coal, bony		0	1½	197	10½
76. Shale, black, carbonaceous		0	2½	197	8
75. Coal, bony		0	8	197	0
74. Shale, black, very hard, calcareous, ferruginous; contains ostracods		0	4	196	8
73. Shale, gray		4	3	192	5
72. Limestone, gray, shaly	*Uniontown*	2	2	190	3
71. Limestone, gray, marly		4	3	186	0
70. Limestone, "cemented breccia"		1	5	184	7
69. Limestone, shaly to marly		1	1	183	6
68. Limestone, composed of cemented nodules and fragments, fossiliferous		1	3	182	3
67. Shale, gray-green, calcareous and siliceous; lower part not well exposed		17	0	165	3
66. Limestone, gray, dense; upper part not well exposed	*Arnoldsburg*	6	11	158	4
65. Shale, serpentine green		3	5	154	11
64. Limestone, irregularly bedded		5	6	149	5
63. Limestone, nodular, weathered		2	10	146	7
62. Shale, green, siliceous	*Fulton*	1	10	144	9
61. Shale, gray-green, sandy		2	3	142	6
60. Limestone, shaly; with some beds to 6″	*Benwood*	6	6	136	0
59. Limestone, shaly, marly		7	9	128	3
58 Limestone, gray, "flint clay" fracture		5	6	122	9
57. Limestone, gray, laminated, weathers platy		3	9	119	0
56. Limestone, dark gray, argillaceous, "fllint clay" fracture		21	0	98	0
55. Limestone, gray-blue, shaly and marly		5	6	92	6
54. Shale, gray, carbonaceous		1	6	91	0
53. Coal, shaly (or shale, coally)	*Meigs Creek*	1	3	89	9
52. Coal, blocky		2	½	87	8½
51. Shale, coally, fine banded; with macerated plant fragments and mica flakes		0	5½	87	3
50. Coal, bright, banded		0	10	86	5
49. Shale, bony and coally		0	3	86	2
48. Clay shale, carbonaceous		0	2	86	0
47. Clay shale, gray, calcareous		1	6	84	6
46. Sandstone, gray, micaceous, calcareous		1	1	83	5
45. Limestone, weathered buff; with irregular shale partings, *Sewickley*		9	6	73	11
44. Covered; indication of carbonaceous shale blossom, *Fishpot*		11	1	62	10

			Ft.	In.	Ft.	In.
43. Limestone, in 1″ to 2″ beds			5	7	57	3
42. Limestone, gray-blue, dense			10	9	46	6
41. Limestone, weathers tan, single bed			1	3	45	3
40. Shale, gray, calcareous			2	2	43	1
39. Limestone, thin-bedded			0	3	42	10
38. Limestone, gray, dense			1	8	41	2
37. Shale, gray, calcareous			0	10	40	4
36. Limestone, dove gray, microbanded, cherty fracture, weathers white		*Fishpot*	1	6	38	10
35. Limestone, tan, shaly			0	3	38	7
34. Limestone, tan, dense; a few calcite crystals			1	7	37	0
33. Shale, dark gray, calcareous			0	2	36	10
32. Limestone, gray-blue, "cemented breccia"			1	1	35	9
31. Shale, gray, calcareous			0	10	34	11
30. Limestone, gray, irregular, dense, marly			3	7	31	4
29. Shale, gray, calcareous			2	11	28	5
28. Coal, bony and shaly, *Pomeroy* (*Redstone*)			0	4	28	1
27. Shale, gray; with carbonaceous streaks			1	10	26	3
26. Limestone, gray, dense, massive, conchoidal fracture			2	4	23	11
25. Limestone, gray-blue, marly; with shale streaks		*Redstone*	8	9	15	2
24. Shale, gray, calcareous			1	4	13	10
23. Limestone, gray-blue, dense, irregular			1	9	12	1
22. Shale, gray, calcareous			2	0	10	1
21. Shale, gray, calcareous, with carbonaceous streaks			2	2	7	11
20. Coal, bony; with shale interbedded	"roof"		1	5	6	6
19. Shale, black, bony	"roof"		0	5	6	1
18. Clay shale, gray; "draw slate"			0	4	5	9
17. Coal, bony, canneloid			0	2½	5	6½
16. Coal, very hard, blocky	"breast"		1	10	3	8½
15. Shale, carbonaceous	"breast"		0	½	3	8
14. Coal, blocky, hard	"breast"		0	3	3	5
13. Shale, carbonaceous			0	½	3	4½
12. Coal, with shaly streaks; "bearing in"		*Pittsburgh*	0	6	2	10½
11. Shale, carbonaceous			0	½	2	10
10. Coal, blocky	"brick"		0	5½	2	4½
9. Shale parting	"brick"		0	¼	2	4¼
8. Coal, blocky	"brick"		1	½	1	3¾
7. Shale, carbonaceous			0	¼	1	3½
6. Coal, blocky; "bottom"			1	½	0	3
5. Coal, shaly and bony			0	3	0	0

Elevation base of *Pittsburgh* coal, 819.5 ft.

CONEMAUGH FORMATION

4. Clay shale, carbonaceous	0	3
3. Shale, sandy, ferruginous	0	8
2. Clay shale, gray	5	2
1. Covered; and limestone, fossiliferous, *Upper Pittsburgh*	5	4

1. Approximately 100 feet of upper Conemaugh strata, mainly Bellaire sandstone, are exposed in the cliff beneath the viaduct but these strata are not included.

18. The "draw slate" is somewhat thinner than is usual in Belmont County.

28. The Pomeroy coal is better exposed just south of the main highway in a side road. It is thinner than is usual in Belmont County.

44. The only covered part of the Monongahela section occurs here where the road crosses a small ravine on a fill.

64–72. The distinction between the Arnoldsburg and Uniontown limestones is not always clear in the absence of the Arnoldsburg coal, which is not known to occur in Ohio;[5] unless well defined sandy beds intervene.[6]

74–82. The Uniontown coal is exposed at road level across the highway from the highway park, a few feet lower than the pump in the park. Of special interest is the limestone parting in the coal.

90–95. The Waynesburg coal is exposed at the top of the cut opposite the pump at the highway park. The section from the Uniontown coal to above the Waynesburg is exposed in the vertical cliff and well shown is the transition from the calcareous character of the Monongahela below the Uniontown to the clastic character above it. The Waynesburg coal is at road level opposite the upper part of the park. It has been mined in the hollow south of the road.

101–103. The Elm Grove limestone is exposed at road level opposite the upper part of the park. The contact between 102 and 103 appears to be an unconformity.

114–117. The limestone strata at this horizon constitute the Mt. Morris member. From St. Clairsville westward to Morristown dark, dirty, greenish gray, ferruginous, argillaceous limestone is well developed at this horizon. The member is present in Pultney, Richland, and Union townships of Belmont County, and probably extends beyond these. It is present in Jefferson County;[7] but in much reduced thickness. At Blaine Hill the Mt. Morris limestone is less ferruginous and does not have the dirty greenish gray color which characterizes the member further west, especially near Morristown in central Union Township.

120. The limestone parting in the Waynesburg "A" coal is noteworthy.

137. The Washington coal is better exposed 50 yards south of the National Road on a road at the east boundary of a cemetery. Its thickness in this section is less than in much of Belmont County.

141–153. The Middle Washington limestone is prominently exposed on the north side of the road in the cut west of the Bellaire Road fork. The Creston ferruginous member, 144, is much better developed as an iron ore 5 miles to the northeast, where it was formerly mined in southeast Section 1, Pease Township.

154–163. Because of the lateral extent of the covered interval 154, the correlation of the members above is less certain than could be desired.

156–163. The calcareous units here called Upper Washington are exposed in the cut at the top of the slope on the south side of the road, opposite Pullman's restaurant. The beds are more or less weathered. They are well and more freshly exposed in a cut one-fourth mile west along the road at a fruit stand on the south side of the road, in southeast Section 28, Richland Township. Here the Upper Washington limestone is fossiliferous; the Jollytown "A" coal 6 inches thick, overlain by 16 feet of sandy shale and thin-bedded Jollytown sandstone.

---

[5]Stout, W., *op. cit.*, 1939.

[6]Lamborn, R. E., "Geology of Jefferson County," *Geol. Surv. Ohio Bull. 35*, pp. 244–246, 1930.

[7]Lamborn, *ibid.*, p. 259.

THE DESMIDS OF THE WEST END OF LAKE ERIE[1,2]

CLARENCE E. TAFT

INTRODUCTION

For several years the writer has had the opportunity to study the desmids of the Island Region of the west end of Lake Erie. First in 1933, and later while a member of the staff of the Franz Theodore Stone Laboratory on Gibraltar Island in Put-in-Bay Harbor during the summers of 1938, 1940, and 1941. Collections made from the open lake, shore margins, and from ponds and beach pools on the Islands were augmented during the interim from 1933 to 1938 by collections made by Tiffany during his work on "The plankton algae of the west end of Lake Erie" (1934) and "The filamentous algae of the west end of Lake Erie" (1937). The writer gratefully acknowledges these collections, as well as many collections placed at his disposal by members of the fresh-water algae classes at the Stone Laboratory.

The writer hopes that this report, the latest in a series on the algae of the region will be not only of taxonomic interest, but helpful to the student of aquatic biology. For the benefit of the latter the paper has been prepared in somewhat greater detail than would otherwise be necessary.

Two groups remain to be reported. They are the Dinophyceae (which has been only superficially worked) and the Bacillariophyceae. Of the two classes, the representatives of the latter are far more numerous, and at times constitute an important bulk of the plankton. It is hoped that in the near future this group may receive the attention that its importance deserves.

DESMID HABITATS OF THE REGION

The survey was limited to a portion of an area generally known as the Island Region of the west end of Lake Erie and is shown on the accompanying map. Although some collections from islands north of this area were examined, they have not been reported.

South Bass Island, on which is located the town of Put-in-Bay, is the largest of the Bass Islands group, and is of little interest algologically beyond the protected inlets located around Put-in-Bay Harbor. There are three of these inlets having semi-pond characteristics and known as Terwilligers Pond, Squaw Harbor, and Hatchery Bay. These are protected considerably from northeast storms by Gibraltar Island and from northwest and southwest storms by the land adjoining the harbor. This protection, along with shallow water, makes them excellent habitats for the higher aquatics. In general they contribute interesting desmid collections, and are especially good for species of *Cosmarium*.

Middle Bass Island, which lies approximately one mile due north of South Bass, contains three shallow ponds, referred to in this report as Wehrle, Fisher, and Haunk. These ponds have mud bottoms and are choked to such an extent with aquatics that, during low water levels, they become veritable marshes whose weedy margins afford the quiet water desirable for desmid collecting.

North Bass Island, slightly more than one mile north of Middle Bass, contains two large ponds or marshes, their classification dependent upon the lake level.

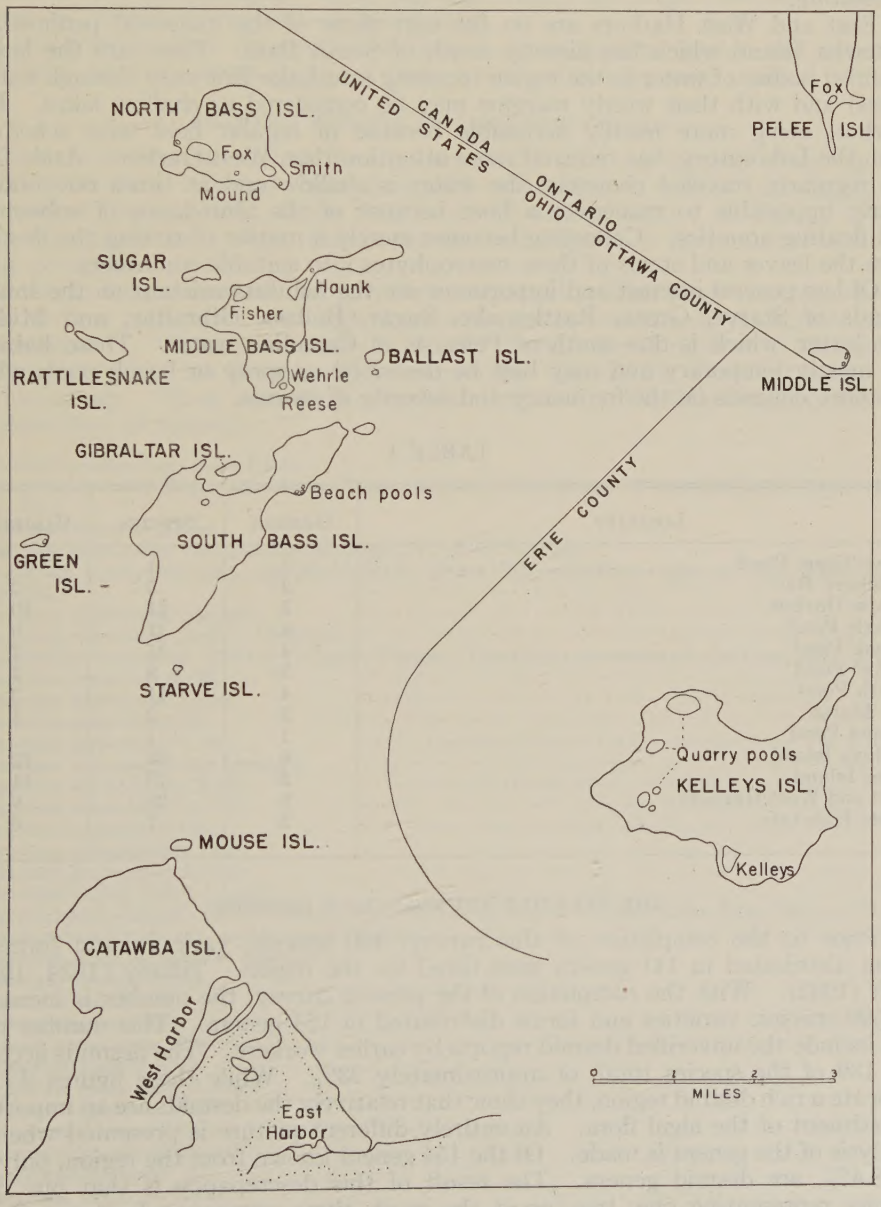
---

[1]Paper from the Department of Botany, The Ohio State University, No. 487, and the Franz Theodore Stone Laboratory, Put-in-Bay, Ohio.

[2]Financial aid for the publication of the plates was granted by the Franz Theodore Stone Laboratory through the Director, Dr. Thomas H. Langlois. For this, as well as the many Laboratory facilities placed at his disposal which made possible the collections, the writer expresses his thanks.

Fox Pond is a natural depression, while Smith Pond is an abandoned carp propagation pond. A third, known as Mound Pond, is located near the south shore dock and exists only during the wetter seasons. A few beach pools in addition to these three ponds constitute the desmid habitats of the Island.

Kelleys Island lies approximately six miles S. E. of South Bass. Although there are some swamp areas, the unique habitats of the Island are the numerous



Map of the Islands Region of the Western End of Lake Erie.
(Adapted from the Put-in-Bay and Kelleys Island Quadrangles of the United States Geological Survey.)

abandoned quarries. The water in these varies from a few inches in depth to forty feet. The desmids, although never abundant in these quarries, appear quite frequently in the bottom ooze of the shallow water.

Pelee Island in Canadian water offers several varied habitats such as drainage ditches, abandoned quarries, canals, and Fox's Marsh; the latter, an extensive peaty area almost entirely choked with aquatic macrophytes, being the most interesting.

East and West Harbors are on the east shore of the mainland peninsula of Catawba Island which lies directly south of South Bass. These are the largest confined bodies of water in the region (opening into Lake Erie only through narrow inlets) and with their weedy margins may be considered as shallow lakes. East Harbor, being more readily accessible because of regular field trips scheduled from the Laboratory, has received more attention than West Harbor. Aside from the regularly traveled channels, the water is shallow and at times one finds it nearly impossible to maneuver a boat because of the abundance of submerged and floating aquatics. Collecting becomes merely a matter of rinsing the desmids from the leaves and stems of these macrophytes into suitable containers.

Of less general interest and importance are the habitats existant on the smaller islands of Starve, Green, Rattlesnake, Sugar, Ballast, Gibraltar, and Middle. The latter, which is due south of Pelee, is in Canadian water. These habitats are mostly temporary and may best be described as spray or beach pools whose existence depends on the frequency and severity of storms.

TABLE I

Locality	Genera	Species	Varieties
Terwilligers Pond	1	1	..
Hatchery Bay	2	5	2
Squaw Harbor	5	21	10
Wehrle Pond	4	11	9
Haunk Pond	4	15	7
Fisher Pond	3	8	7
Smith Pond	4	11	2
Fox Marsh	3	2	1
Mound Pond	1	1	..
Kelleys Island	6	24	12
Pelee Island	5	13	11
East and West Harbors	9	28	9
Other Habitats	2	7	6

THE RELATIVE ABUNDANCE OF DESMIDS

Prior to the completion of this survey, 460 species, varieties and forms of algae distributed in 141 genera were listed for the region. Tiffany (1934, 1937), Taft (1942). With the completion of the present survey, the number is increased to 599 species, varieties and forms distributed in 154 genera. This number does not include the unverified desmid reports by earlier workers. The desmids account for 139 of the species total, or approximately 23%. While these figures do not indicate a rich desmid region, they show that relatively the desmids are an important constituent of the algal flora. An entirely different picture is presented when an analysis of the genera is made. Of the 154 genera known from the region, only 13, or 8.4%, are desmid genera. The result of this descrepancy is that one finds species representing one, two, or at the most, three genera predominant in the collections. Representatives of genera other than *Closterium*, *Cosmarium*, and *Staurastrum* are not common. The explanation of this phenomena is not entirely

clear although to one familiar with the region and with desmid distribution the data are not exactly irrelevant. Desmids are usually encountered in numbers (both genera and species) only in sandy or boggy regions where the waters are acid. Limestone regions with their subsequent hard water, are notoriously poor in the desmid flora they support. Consequently the Island Region of the west end of Lake Erie, with its alkaline waters (pH 7 to pH 10) should not be expected to yield a rich desmid flora. It is this that makes the large number of species present an interesting problem in distribution.

Table I summarizes the relative abundance of the genera, species, and varieties of desmids in the various locations from which collections were made.

PREVIOUS REPORTS ON LAKE ERIE DESMIDS

There have been no reports dealing exclusively with the desmids of the region. Papers which have included them along with other algae as well as vascular plants are those of Pieters (1901), Snow (1902) and Chandler (1940). As Tiffany (1934, 1937) did not include them, this is the first attempt at a comprehensive study of the group.

Unfortunately many of the previously reported species have not reappeared in the writers collections, although in some instances varieties of the species have been collected. This may partially be due to the fact that a number of the earlier reports were from the Portage River, which lies outside the arbitrary limits set for this survey. These unverified records are included in the following list, but are not described or figured.

Closterium acutum var. *linea* Klebs.
(*Closterium pronum* Bréb. var. *linea* Klebs, Pieters, The plants of western Lake Erie, 1901, p. 79.)
Closterium lineatum Ehren.
Cosmarium angulosum var. *concinnum* (Rab.) W. & G. S. West.
(*Cosmarium meneghinii* var. *concinnum* Rab., Snow, The plankton algae of Lake Erie, 1902, p. 392.)
Cosmarium brébissonii Menegh.
Cosmarium connatum (Bréb.) DeBary.
(*Disphinctium connatum* (Bréb.) DeBary, Pieters, The plants of western Lake Erie, 1901, p. 79).
Cosmarium crenatum Ralfs.
Cosmarium depressum Lund.
Cosmarium euastroides N.
Cosmarium kjellmanii Wille.
Cosmarium margaritiferum Menegh.
Cosmarium moniliforme Ralfs.
Cosmarium nitidulum De Not.
Cosmarium ornatum Ralfs.
Cosmarium punctulatum Bréb.
Cosmarium pygmaeum Archer.
Cosmarium ralfsii (Bréb.) Lund.
(*Pleurotaenopsis ralfsii* (Bréb.) Lund., Pieters, The plants of western Lake Erie, 1901, p. 79.)
Cosmarium reniforme var. *compressum* Nordst.
Cosmarium tetraophthalmum Kuetz.
Cosmarium tinctum Ralfs.
Euastrum binale Ralfs.
Euastrum elegans Kuetz.
Euastrum verrucosum Ehren.
Staurastrum avicula Bréb.
Staurastrum brebissonii Archer.
Staurastrum dejectum Bréb.
Staurastrum dilatum Ehren.
Staurastrum gracile Ralfs.
Staurastrum oblongum N.
Staurastrum teliferum Ralfs.
Xanthidium antilopeum Kuetz.
Hyalotheca dissiliens Bréb.
Onychonema laeve Nordst. var. *minus* Borge.
Onychonema filiforme (Ehren.) R. & B.
(*Sphaerozosma filiforme* Rab., Snow, The plankton algae of Lake Erie, 1902, p. 392.)

THE DESMIDS

The name "desmids" as used in this report assumes the original meaning and applies to the organisms now grouped in two Families, the Mesotaeniaceae and the Desmidiaceae within the Order *Zygnematales* of the Class *Chlorophyceae*. In general they are unicellular plants of varied form, symmetrical in three planes at right angles to each other. Most of the members of the *Desmidiaceae* are divided into two equal semi-cells by a more or less prominent median constriction. Those of the *Mesotaeniaceae*, while never distinctly constricted, usually have the protoplasm and the plastids divided into two equal halves. The members of the *Desmidiaceae* are further separated from the *Mesotaeniaceae* by having their walls composed of two over-lapping halves instead of being continuous, and with a differentiated outer layer with pores.

Because of the general availability of standard references concerning this group, a complete taxonomic treatment has not been attempted by the writer. However, the problems of the student of aquatic biology have been considered and the report prepared accordingly. A key to the genera, as well as brief descriptions of the species, has been included. Illustrations are from the writer's original camera lucida drawings.

Keys to the species, if they attempt to give the necessary differentiating characters, become exceedingly complex, and subsequently defeat their purpose of simplification. Therefore such keys have been excluded. The student, after determining the genus, should work by constant reference to descriptions and figures. The identification of a species is best attempted from a number of individuals which will give the variations, instead of from what may turn out to be a non-typical individual.

NEW SPECIES AND VARIETIES

Seven species and seven varieties have been named and described, while one form has been given varietal rank.

Closterium eriense sp. nov.
Euastrum ohioense sp. nov.
Cosmarium eriense sp. nov.
Cosmarium franzstonii sp. nov.
Cosmarium impressulum var. *suborthogona* (W. & G. S. West) Comb. nov.
Cosmarium nitidulum var. *pseudovalidum* var. nov.
Cosmarium reniforme var. *seminudum* var. nov.
Cosmarium subnudiceps var. *granulatum* var. nov.
Cosmarium subraciborskii sp. nov.
Cosmarium viride var. *compressum* var. nov.
Staurastrum biarcuus sp. nov.
Staurastrum bicoronatum var. *tridentatum* var. nov.
Staurastrum brevispinum var. *canadense* var. nov.
Staurastrum pelei sp. nov.
Staurastrum polytrichum Perty var. *ornatum* var. nov.

KEY TO THE GENERA

1. Filamentous 11
1. Unicellular (sometimes in readily disassociating filaments) 2
   2. Cell length not more than twice the breadth 8
   2. Cell length twice the breadth, or more 3
3. Without a median constriction 4
3. With a more or less distinct median constriction 7
   4. Chloroplasts ribbon-like, axial, straight; cells in readily disassociating filaments, **Gonatozygon**
   4. Chloroplasts not ribbon-like 5
5. Chloroplasts substellate, 2 per cell; cells sometimes slightly curved ..... **Cylindrocystis**
5. Chloroplasts longitudinally ridged, two per cell 6
   6. Cells straight, nearly cylindrical, apices broadly rounded ..... **Penium**
   6. Cells usually strongly curved, apices attenuated ..... **Closterium**

7. Median constriction indistinct; cells nearly cylindrical, apices broadly rounded; semicells not inflated at the base. . . . **Penium**
7. Median constriction distinct; cells cylindrical, apices broadly rounded to truncate; base of semi-cell inflated, not plicate. . . . **Pleurotaenium**
8. Cells compressed. . . . 9
8. Cells radially symmetrical, if compressed then with apical angles produced into divergent processes. . . . **Staurastrum**
9. Margins of semi-cells variously lobed, apex sometimes incised. . . . 10
9. Margins of semi-cells seldom lobed (sometimes undulate or crenate), sometimes with spines; apex not incised. . . . **Cosmarium**
10. Lateral lobes separated by shallow incisions, apex usually deeply incised; cell wall variously ornamented. . . . **Euastrum**
10. Lateral lobes separated by deep incisions, apex with shallow incision, or retuse, **Micrasterias**
11. Cells united by special apical processes, compressed; filaments not twisted. . **Sphaerozosma**
11. Cells not united by apical processes. . . . 12
12. Cells triangular in vertical view, median constriction distinct; filaments twisted, **Desmidium**
12. Cells not triangular in vertical view. . . . 13
13. Cells circular in vertical view, median constriction indistinct. . . . **Hyalotheca**
13. Cells elliptical in vertical view, median constriction deep. . . . **Spondylosium**

SPECIES LIST

Gonatozygon De Bary 1856

Cells cylindrical, length 10–20 times the diameter, not constricted, apices truncate and slightly inflated, in filaments which readily disassociate. Chloroplasts two, axial, narrow and undulate, pyrenoids numerous.

1. *Gonatozygon kinahani* (Arch.) Rab. (Pl. I, Fig. 1) L. 135–195μ, w. 11–12μ. Squaw Harbor.
2. *Gonatozygon monotaenium* De Bary (Pl. I, Fig. 2) L. 101–190μ, w. 9–10μ. Kelleys Isl. quarry pools.

Cylindrocystis Menegh. 1838

Cells cylindrical, sometimes slightly curved, length varying to 3½ times the diameter, unconstricted, apices rounded, embedded in mucilage; with two axial, stellate chloroplasts; pyrenoids large, one in each chloroplast.

1. *Cylindrocystis brebissonii* Menegh. var. *minor* W. & G. S. West (Pl. I, Fig. 3) L. up to 42μ, w. 12–13μ. Partially submerged rocks, Gibraltar.

Penium Bréb. 1844

Cells cylindrical to fusiform, with or without a slight median constriction, apices rounded or subtruncate; chloroplasts one or two in each semicell, each a central mass with radiating longitudinal plates, plates entire along the margins; pyrenoids axial, one or more; cell wall with pores.

1. *Penium margaritaceum* (Ehren.) Bréb. (Pl. I, Fig. 4). L. 115–184μ, w. 21–23μ. East Harbor, Kelleys Isl., Manila Bay.

Pleurotaenium Naeg. 1849

Cells straight, elongated, cylindrical, constricted, semicells with a non-plicate, inflated base; apex with or without tubercles; chloroplasts numerous, parietal, longitudinal bands.

1. *Pleurotaenium ehrenbergii* (Breb.) De Bary (Pl. I, Figs. 5, 6). L. 270–520μ, w. at base 27–30μ, w. at middle of semicell 25–35μ, w. at apex 16–18μ, isth. 21–23μ. Pelee.

   Many individuals showed a distinct shortening and tumidness of the semicells, but there were all gradations between these and the typical forms.
2. *Pleurotaenium trabecula* (Ehren.) Naeg. (Pl. I, Fig. 7). L. 360–580μ, w. at base 26–35μ, w. at apex 20–23μ. Wehrle, Fisher, Squaw Harbor.

Closterium Nitzsch 1817

Cells elongate, more or less attenuate, slightly curved to strongly lunate, unconstricted; ends of cells rounded, truncate or sharply pointed; cell wall smooth or striate, colorless to brown;

one axial chloroplast per semicell, each with longitudinal, radiating ridges; pyrenoids few to many, axial or scattered; each end of the cell with a vacuole containing moving granules of calcium sulphate.

1. *Closterium acerosum* (Schrank) Ehren. (Pl. I, Fig. 8). Cell wall smooth, colorless, often becoming yellow when old; chloroplast with 14–16 ridges and an axial series of about 10 pyrenoids. L. 340–475μ, w. 40–60μ. Squaw Harbor, Hatchery Bay, East Harbor.
2. *Closterium calosporum* Wittr. (Pl. I, Fig. 9). Cell wall smooth and colorless. L. 160μ, w. 13μ, zygospore about 32μ. Kelleys Isl.

   This species is very similar to *Cl. dianae* but the spore is distinctive.
3. *Closterium dianae* Ehren. (Pl. I, Fig. 10). Cell wall smooth, very pale yellow; chloroplast with about 4 ridges and 3–4 pyrenoids. L. 147–160μ, w. 13–14μ. Kelleys Isl.
4. *Closterium eboracense* (Ehren.) Turner (Pl. I, Fig. 11). Cell wall smooth and colorless; chloroplasts with about eight ridges and 4 pyrenoids. L. 220μ, w. 47μ. Squaw Harbor.
5. *Closterium ehrenbergii* Menegh. (No figure). Cell wall smooth and colorless; chloroplasts with 10–12 ridges and numerous scattered pyrenoids. L. 420–590μ, w. 80–101μ. Wehrle, Fisher, Haunk, Terwilliger's, East Harbor, Fox.
6. **Closterium eriense** Taft n. sp. (Pl. I, Fig. 12). Cells of medium size, seven times longer than broad, strongly curved (almost 180 degrees of arc), inner margin concave, not tumid, gradually attenuated to broadly rounded apices; cell wall smooth and very light yellow; chloroplasts? L. 215μ, w. 30μ, w. of apices 10μ. Squaw Harbor.

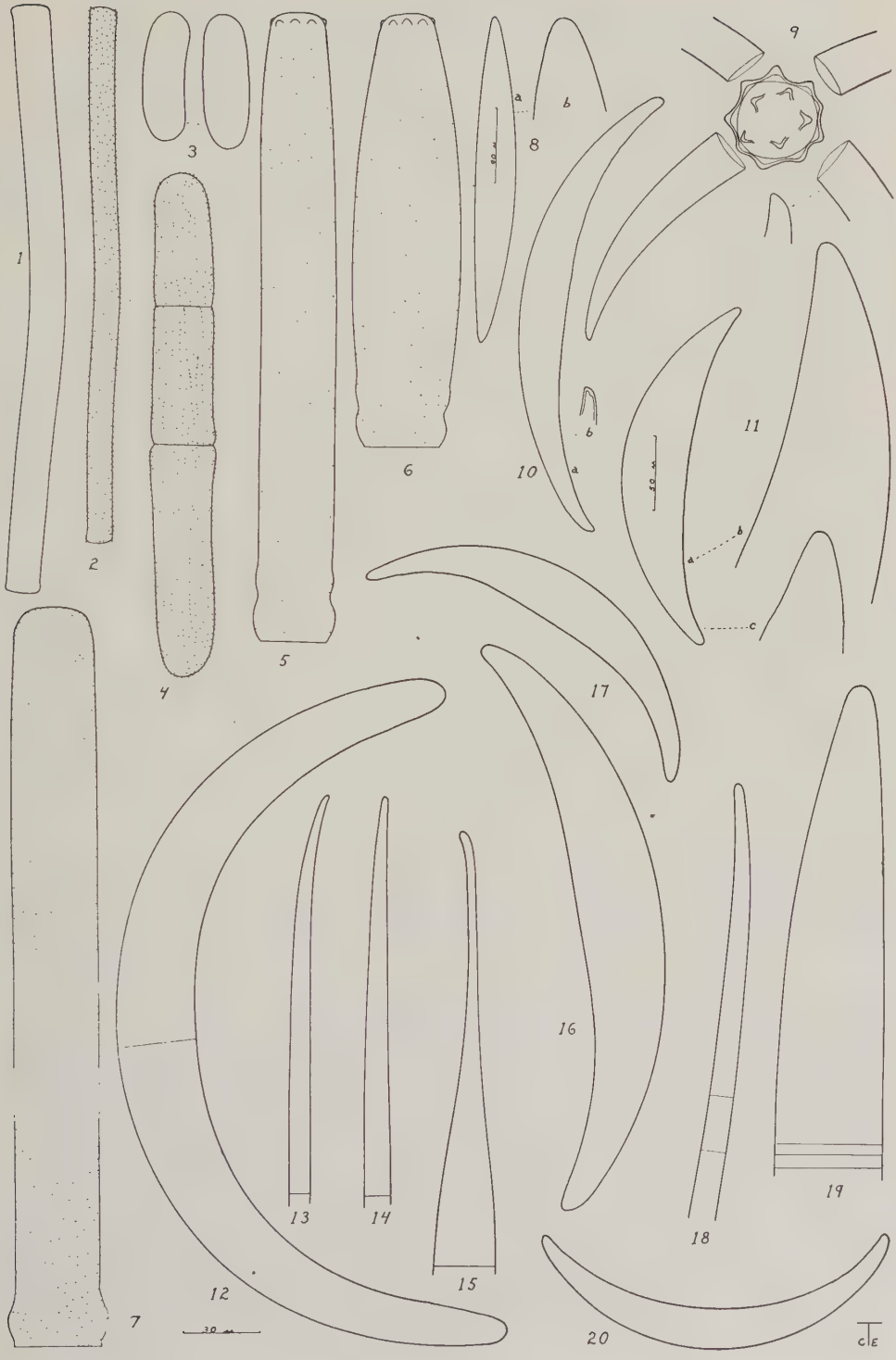
   Cl. mediocre, cellulis diametro 7 plo longioribus, ventre concavo, non distincte tumido, gradatim attenuatis apicibus versus, apicibus rotundatis; membrana glabra, luteola. Long. 215μ, lat. 30μ, lat. apic. 10μ.

   Although this must stand at the present as an incompletely described species because of the advanced decomposition of the chloroplasts when collected, it differs sufficiently to be given specific rank. Its greater size and the broadly rounded apices separate it from *Cl. parvulum* var. *angustum* W. & G. S. West. It is larger and less curved than *Cl. cynthia* var. *curvatissimum* W. & G. S. West.
7. *Closterium gracile* Bréb. (Pl. I, Fig. 13). Cell wall smooth and colorless; chloroplasts with about 6 pyrenoids. L. 211μ, w. 7μ. East Harbor.
8. *Closterium idiosporum* W. & G. S. West (Pl. I, Fig. 14). Cell wall smooth and colorless; chloroplasts faintly 4-ridged, with about 5 pyrenoids. L. 197–232μ, w. 9–10μ. Wehrle.
9. *Closterium kützingii* Bréb. (Pl. I, Fig. 15). Cell wall finely striate (about 12 striae per 10μ), becoming dark yellow when old; chloroplasts with about 4 ridges and 6 pyrenoids. L. 273–380μ, w. 20μ. Pelee.
10. *Closterium leibleinii* Kuetz. (Pl. I, Fig. 17). Cell wall smooth and colorless, sometimes very light yellow; chloroplasts with about 6 ridges and 3 pyrenoids. L. 115–121μ, w. 18–21μ. Haunk, Hatchery Bay, East Harbor.

    This species is variable as to size and curvature, especially the latter.
11. *Closterium lunula* (Muell.) Nitz. var. *coloratum* Klebs. forma? (Pl. I, Fig. 19). Cells quite large, between 7–10 times longer than broad, inner wall straight, outer wall broadly convex; apices broadly rounded; cell wall finely striate (10 striae per 10μ), yellow brown; chloroplasts with 10–12 ridges and numerous scattered pyrenoids. L. 330–375μ, w. 37–44μ. Squaw Harbor.

EXPLANATION OF PLATE I

Fig. 1. *Gonatozygon kinahani*. Fig. 2. *Gonatozygon monotaenium*. Fig. 3. *Cylindrocystis brebissonii* var. *minor*. Straight and curved cells. Fig. 4. *Penium margaritaceum*. Figs. 5, 6. *Pleurotaenium ehrenbergii*. Fig. 7. *Pleurotaenium trabecula*. Fig. 8a, b. *Closterium acerosum*. 8a, outline of cell; 8b, apex. Fig. 9. *Closterium calosporum*, with zygospore. Fig. 10a, b. *Closterium dianae*. 10a, outline of cell; 10b, detail of apex. Fig. 11a, b, c. *Closterium eboracense*. 11a, outline of cell; 11b, semicell; 11c, apex. Fig. 12. *Closterium eriense*. n. sp. Fig. 13. *Closterium gracile*. Semicell. Fig. 14. *Closterium* idiosporum. Semicell. Fig. 15. *Closterium kützingii*. Semicell. Fig. 16. *Closterium moniliferum*. Fig. 17. *Closterium leibleinii*. Fig. 18. *Closterium macilentum*. Fig. 19. *Closterium lunula* var. *coloratum* forma? Fig. 20. *Closterium parvulum*.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
a
b
c
50 μ
30 μ
C E

As this form is only one-half or one-third as broad as *Cl. lunula* var. *coloratum* there is some doubt as to its correct systematic position. Because of the close resemblance in regard to other characters, it will be left as a form of the variety *coloratum* Klebs.

12. *Closterium macilentum* Breb. (Pl. I, Fig. 18). Cell wall smooth and colorless (very faintly yellow in old specimens); chloroplasts with 8–10 pyrenoids. L. 270μ, w. 7μ. Smith.
13. *Closterium moniliferum* (Bory) Ehren. (Pl. I, Fig. 16). Cell wall smooth and colorless; chloroplasts with about 6 ridges and 5–6 axial pyrenoids. L. 204–310μ, w. 27–53μ. Fisher, Smith, Squaw Harbor, Hatchery Bay, East Harbor.
14. *Closterium parvulum* Naeg. (Pl. I, Fig. 20). Cell wall smooth and colorless; chloroplasts with 5–6 ridges and about 4 pyrenoids. L. 110–119μ, w. 13–18μ. Wehrle, Smith, Fox, Squaw Harbor.
15. *Closterium parvulum* var. *angustum* W. & G. S. West (Pl. II, Fig. 1). Cells much narrower and usually shorter than in the species, curvature greater; otherwise similar. L. 96–121μ, w. 5–7μ. Hatchery Bay, Kelleys Isl., East Harbor.
16. *Closterium praelongum* Bréb. (Pl. II, Fig. 2). Cell wall nearly colorless to yellow, appearing smooth (Krieger, 1935, reports 15 striae per 10μ when the wall is examined with oil immersion lens), chloroplasts with about 5 ridges and 10 pyrenoids. L. 860μ, w. 24μ. Pelee.
17. *Closterium praelongum* var. *brevius?* Nordst. (Pl. II, Fig. 3). Similar to the species but with smaller dimensions. L. 365–410μ, w. 18μ. Fisher.

    The specimens were intermediate in size between the species proper and the variety *brevius*. They have been assigned to the variety on the basis of the ratio of the axes.
18. *Closterium pritchardianum* Arch. (Pl. II, Fig. 4). Cell wall finely striate (9–10 striae per 10μ), striae composed of fine punctae, often subspiral, color yellow to red-brown; chloroplasts with 6–8 ridges and about 8 axial pyrenoids. L. 334–530μ, w. 21–37μ. Haunk, Fisher, Mound, Squaw Harbor, Hatchery Bay.
19. *Closterium subulatum* (Kuetz.) Breb. (Pl. II, Fig. 5). Cell wall smooth and colorless; chloroplasts with 3–4 pyrenoids. L. 128–188μ, w. 7–10μ. Fisher, Smith.
20. *Closterium venus* Kuetz. (Pl. II, Fig. 6). Cell wall smooth and colorless; chloroplasts ridged, with 2 (sometimes 3) pyrenoids. L. 76–85μ, w. 9–14μ. Haunk.
21. *Closterium venus* var. *incurvum* (Bréb.) Krieger (Pl. II, Fig. 7). Cell wall smooth and colorless, rarely yellowish when old; chloroplast with 3–4 pyrenoids. L. 39–66μ, w. 7–12u. Haunk, Smith, Squaw Harbor, East Harbor.

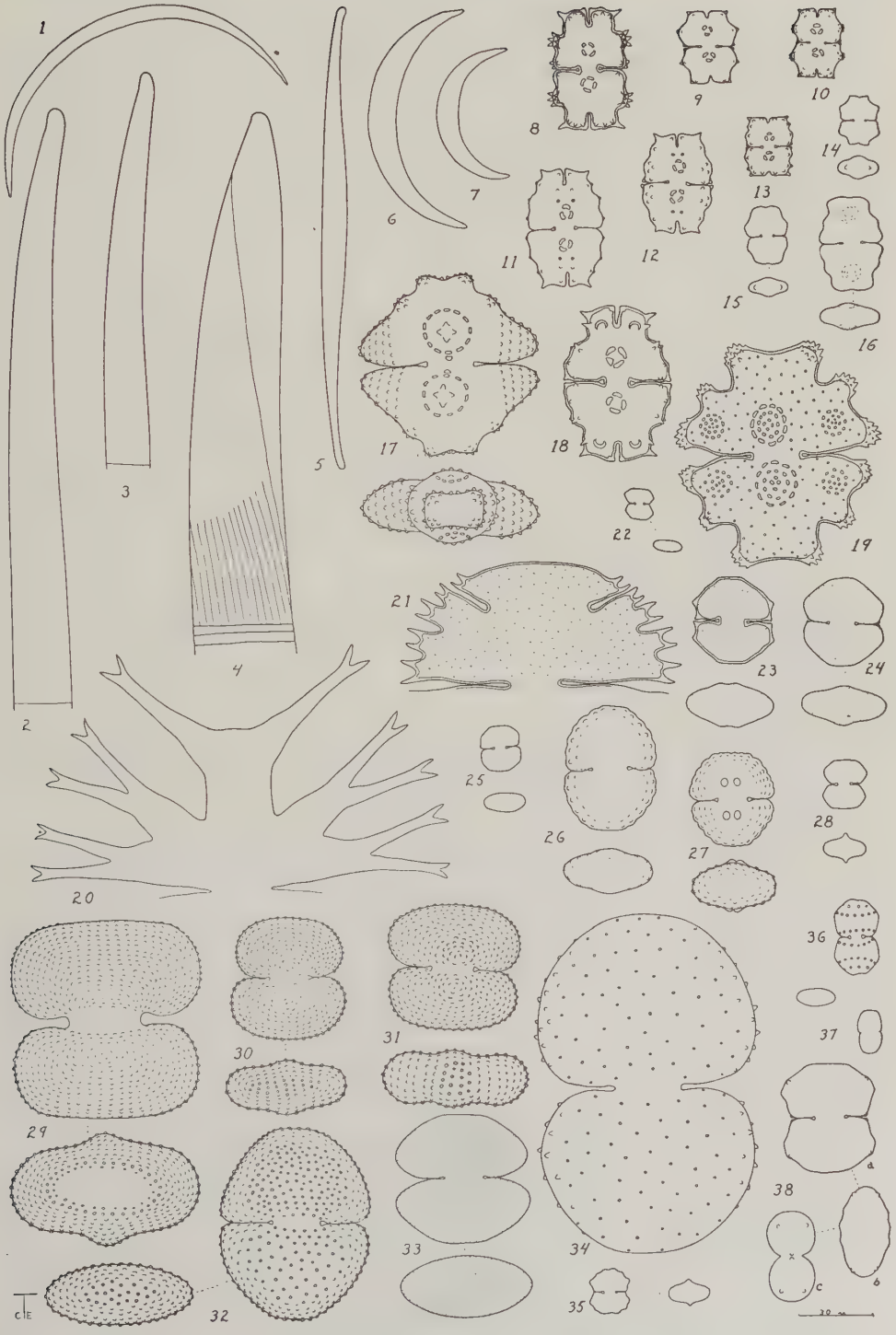
Euastrum Ehren. 1832

Cells variable in size, longer than broad, sometimes about as broad as long, strongly compressed, deeply constricted, sinus linear; semicells usually pyramidate, lateral margins variously lobed, center of semicell with one or more protuberances, apex usually truncate with an incision

---

EXPLANATION OF PLATE II

Fig. 1. *Closterium parvulum* var. *angustum*. Fig. 2. *Closterium praelongum*. Fig. 3. *Closterium praelongum* var. *brevius?* Fig. 4. *Closterium pritchardianum*. Fig. 5. *Closterium subulatum*. Fig. 6. *Closterium venus*. Fig. 7. *Closterium venus* var. *incurvum*. Fig. 8. *Euastrum abruptum*. Fig. 9. *Euastrum abruptum* var. *lagöense*. Fig. 10. *Euastrum abruptum* var. *lagöense forma?* Figs. 11, 12. *Euastrum bidentatum*. Two cells with variable granulation. Fig. 13. *Euastrum dubium forma?* Fig. 14. *Euastrum binale* var. *hains*. Fig. 15. *Euastrum insulare* var. *silesiacum?* Fig. 16. *Euastrum lutkemulleri*. Fig. 17. *Euastrum ohioense*, n. sp. Fig. 18. *Euastrum quebecense*. Fig. 19. *Euastrum verrucosum* var. *alatum*. Fig. 20. *Micrasterias radiata*. Fig. 21. *Micrasterias truncata*. Near the var. *semiradata*. Fig. 22. *Cosmarium abbreviatum*. Fig. 23. *Cosmarium angulare*. Fig. 24. *Cosmarium angulare* var. *canadense*. Fig. 25. *Cosmarium angulosum*. Fig. 26. *Cosmarium aphanichondrum*. Fig. 27. *Cosmarium bipunctatum*. Fig. 28. *Cosmarium bireme*. Fig. 29. *Cosmarium biretum*. Fig. 30. *Cosmarium biretum* var. *minus*. Fig. 31. *Cosmarium biretum* var. *trigibberum*. Fig. 32. *Cosmarium botrylis*. Fig. 33. *Cosmarium depressum* var. *achondrum*. Fig. 34. *Cosmarium dentatum*. Fig. 35. *Cosmarium crenulatum* var. *tumidulum*. Fig. 36. *Cosmarium difficile* var. *sublaeve*. Fig. 37. *Cosmarium exiguum?* Fig. 38a, b, c. *Cosmarium eriense*, n. sp. 38a, face view of cell; 38b, end view; 38c, side view.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
a
b
c

of variable depth; vertical view elliptic with variously disposed protuberances on either side. One irregularity lobed and ridged chloroplast with one or more pyrenoids in each semicell.

1. *Euastrum abruptum* Nordst. (Pl. II, Fig. 8). L. 38–41μ, w. 27–28μ, w. polar lobe 18μ, isth. 6–7μ. East Harbor.

   There was some variability in the number and position of the granules, but in general the cells were remarkably constant.

2. *Euastrum abruptum* var. *lagöense* (Nordst.) Krieger (Pl. II, Fig. 9). L. 23–27μ, w. 18–21μ, w. polar lobe 12–14μ, isth. 4–5μ. East Harbor.

   The conical tooth on the lateral lobes of some cells was pronounced while in others it was lacking.

3. *Euastrum abruptum* var. *lagöense* (Nordst.) Krieger forma? (Pl. II, Fig. 10). L. 24μ, w. 18μ, isth. 4μ. East Harbor.

   Several cells were seen which were constant in size, and were undoubtedly variations of the variety *lagöense*. They differed by having three small granules on the margins of each lateral lobe and four pronounced granules within the apex on each side of the apical incision.

4. *Euastrum bidentatum* Naeg. (Pl. II, Figs. 11, 12). L. 32–41μ, w. 24–26μ, isth. 4–7μ. East Harbor, Pelee.

   The material, as might be expected, was quite variable. Although the general outline of the cells was fairly constant, there was a great deal of variation in the granulation, and sometimes in the granulation of the two semicells of one plant.

5. *Euastrum dubium* Naeg. forma? (Pl. II, Fig. 13). L. 19–23μ, w. 16–19μ, w. polar lobe 12–13μ, isth. 3–5μ. Haunk, East Harbor.

   The writer doubtfully includes this as a form of *Eu. dubium* Naeg. As only occasional cells were encountered, the extent of its variability has not been ascertained.

6. *Euastrum binale* (Turp.) Ehren. var. *hians* (W. West) Krieger (Pl. II, Fig. 14). L. 14–17μ, w. 11–13μ, isth. 3–4μ. Kelleys Isl.

7. *Euastrum insulare* (Wittr.) Roy var. *silesiacum?* Grönblad (Pl. II, Fig. 15). L. 19–20μ, w. 14μ, isth. 3–4μ. Pelee.

   There appears to be some question in the minds of various workers as to the exact differences between *Eu. binale* and its varieties and *Eu. insulare* and its varieties. This material has some characters referable to both, but it has been questionably placed with the latter.

8. *Euastrum lütkemulleri* Duc. (Pl. II, Fig. 16). L. 28μ, w. 21μ, isth. 7μ. Kelleys Isl.

   In outline this is almost identical to the figure given by Rich (1935) for *Eu. insulare* (Wittr.) Roy *forma*. The dimensions however are noticeably greater. Krieger (1937) includes this form in *Eu. lütkemulleri* Duc. In a very general way it may resemble this species in size and outline, but the wall characters seem to be entirely different. While Rich gives no clue as to the wall character or the shape of the vertical view beyond saying that it belongs to *Eu. insulare*, the Lake Erie material definitely does not have the wall structure of *Eu. lütkemulleri*. The writer believes that the Lake Erie and South African material is comparable and that it should be given specific rank. Until additional material is available for study, it will be referred to *Eu. lütkmulleri* Duc.

9. **Euastrum ohioense** Taft n. sp. (Pl. II, Fig. 17). Cells of medium size, as broad as long, dimensions extremely constant, deeply constricted, sinus closed, then opening outwards; semicells broadly pyramidate; polar lobe with a broad cuneate depression, each angle furnished with small, conical teeth, about four showing on the face within each angle; lateral margins slightly concave, each with a slight protuberance immediately below the polar lobe, each protuberance showing three conical teeth along the margin and three within the margin; basal lobes sharply rounded, each with about five vertical rows of conical granules; the center of each semicell furnished with four conical granules surrounded by a ring of flattened, rectangular granules and one conspicuous granule immediately above the isthmus; vertical view with a median tumid area showing three conical granules and a portion of the ring of granules, ends with about five rows of conical granules. L. 60μ, w. 60μ, w. polar lobe 23μ, isth. 16μ. East Harbor.

Cellulae mediocres, tam latae quam longae, mensuris constantissimis, alte constrictae, sinu clauso, deinde extra se pandente; semicellulae late pyramidatae; lobulo polare late et cuneate depresso, omni angulo dentibus parvis conicisque ornatis, circa quattuor in superficie in omni angulo aspectabilibus; margines laterales aliquantum concavi, quoque proxime infra lobulum polarem protuberationem parvem praebente, omni protuberatione tres dentes conicos secundum marginem et tres in margine praebente; lobuli basales acute rotundi, quoque circa quinque ordines rectos granulorum conicicorum praebente; centro omnis semicellulae quattuor granulis conicis orbe granulorum complanatorum orthogoniorumque et uno granulo conspicuo proxime super isthmum circumclusis ornato; a vertice aspectus, area tumida media tria granula conica et partem orbis granulorum praebente, in circa quinque ordines granulorum conicorum desinit. Long. 60μ, lat. 60μ, lat. isth. 16μ.

This desmid, with slight variations, has appeared in the writer's collections from Oklahoma and from fossil material in Ohio as well as from the Lake Erie Region. While the cell outline is constant the granulation appears to be somewhat variable in the specimens from the different localities. It should be compared with *Eu. hypochondrum* Nordst. from which it differs by having a depressed polar lobe, more sharply rounded basal angles, slightly different granulation of the polar lobe, and different dimensions.

10. *Euastrum quebecense* Irenee-Marie (Pl. II, Fig. 18). L. 55μ, w. 37μ, w. polar lobe 23μ, isth. 6μ. Pelee.
11. *Euastrum verrucosum* Ehren. var. *alatum* Wolle (Pl. II, Fig. 19). L. 76–80μ, w. 62–67μ, w. polar lobe 30–35μ, isth. 16–18μ. Kelleys Isl., Pelee.

Micrasterias Ag. 1827

Cells variable in size, greatly compressed, with a very deep, nearly linear, median incision; semicells usually five lobed; apical lobe widely cuneate; lateral lobes bilobulate; face of semicell without granulate protuberances; one lobed chloroplast with many pyrenoids in each semicell.

1. *Micrasterias radiata* Hass. (Pl. II, Fig. 20). L. 140μ, w. 106μ, w. of polar lobe 89μ, isth. 18μ. East Harbor.
2. *Micrasterias truncata* (Corda) Bréb. near the var. *semiradiata* Cleve (Pl. II, Fig. 21). L. 80–88μ, w. including teeth 92–96μ, w. without teeth 83μ, isth. 11–13μ. East Harbor.

Members of the genus *Micrasterias* are rare in the Island Region of Lake Erie. As yet there are no verified records of the occurrence of a single species on the Islands. The two species reported are from the mainland, and one of these two, *M. truncata* var. ? is the only one that may be reported as abundant.

Cosmarium Corda 1834

Cells extremely variable in size, usually somewhat longer than broad, more or less compressed, usually with a fairly deep median constriction; cells variable in outline, without radiating processes or spines; vertical view usually oblong or elliptic, often with a central protuberance; chloroplasts usually axial, with one or two pyrenoids; cell wall varying from smooth to papillate, markings usually forming a definite pattern.

1. *Cosmarium abbreviatum* Racib. (Pl. II, Fig. 22). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 10–11μ, w. 9–10μ, isth. 2–3μ. Squaw Harbor.

The dimensions of these individuals were intermediate between *Cos. abbreviatum* Racib. and the forma *minor* W. & G. S. West. They have been referred to the species with the feeling that forma *minor* represents the minimum size range of the species.

2. *Cosmarium angulare* Johnson (Pl. II, Fig. 23). Cell wall indistinctly punctulate; chloroplasts axial, with one pyrenoid. L. 28–30μ, w. 25–27μ, isth. 6–8μ. Kelleys Isl., Fisher.
3. *Cosmarium angulare* var. *canadense* Irenee-Marie (Pl. II, Fig. 24). Cell wall indistinctly punctulate; chloroplasts axial, with one pyrenoid. L. 28–29μ, w. 26–27μ, isth. 7–8μ. Fisher, Wehrle, Pelee.

Irenee-Marie (1938) states in his description that this variety is distinguished from the species "*par l'absence de protubérance au milieu des hémisomates*, de sorte que la vue apicale est parfaitment elliptique." In the Lake Erie material which was associated

with the species, the vertical view showed a slight tumid condition. In other respects it resembles the specimens described by Irenee-Marie.

4. *Cosmarium angulosum* Bréb. (Pl. II, Fig. 25). Cell wall smooth, chloroplasts axial, with one pyrenoid. L. 16μ, w. 14μ, isth. 3–4μ. Squaw Harbor.
5. *Cosmarium aphanichondrum* Nordst. (Pl. II, Fig. 26). Chloroplasts axial, with one pyrenoid. L. 39–40μ, w. 32μ, isth. 9μ. Squaw Harbor, Beach pools, Middle Bass.
6. *Cosmarium bipunctatum* Borg. (Pl. II, Fig. 27). Chloroplasts axial, with one pyrenoid. L. 27–31μ, w. 25–30μ, isth. 8μ. Squaw Harbor.
7. *Cosmarium bireme* Nordst. (Pl. II, Fig. 28). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 16–17μ, w. 14–15μ, isth. 3–4μ. Squaw Harbor, East Harbor.
8. *Cosmarium biretum* Bréb. (Pl. II, Fig. 29). Chloroplasts axial, with two pyrenoids. L. 64–65μ, w. 60–64μ, isth. 21–23μ. Smith, Dock on North Bass.

   Nearly all the specimens exhibited the open sinus, a peculiar character for this species.
9. *Cosmarium biretum* var. *minus* Hansg. (Pl. II, Fig. 30). L. 39–41μ, w. 36–38μ, isth. 11–12μ. Middle Isle.

   The upper angles are rounded more than usual in this variety.
10. *Cosmarium biretum* var. *trigibberum* Nordst. (Pl. II, Fig. 31). L. 43μ, w. 43μ, isth. 14μ. Haunk, Squaw Harbor, Middle Bass.
11. *Cosmarium botrytis* Menegh. (Pl. II, Fig. 32). Chloroplasts axial with two pyrenoids. L. 60–66μ, w. 50–53μ, isth. 16–18μ. Pelee.

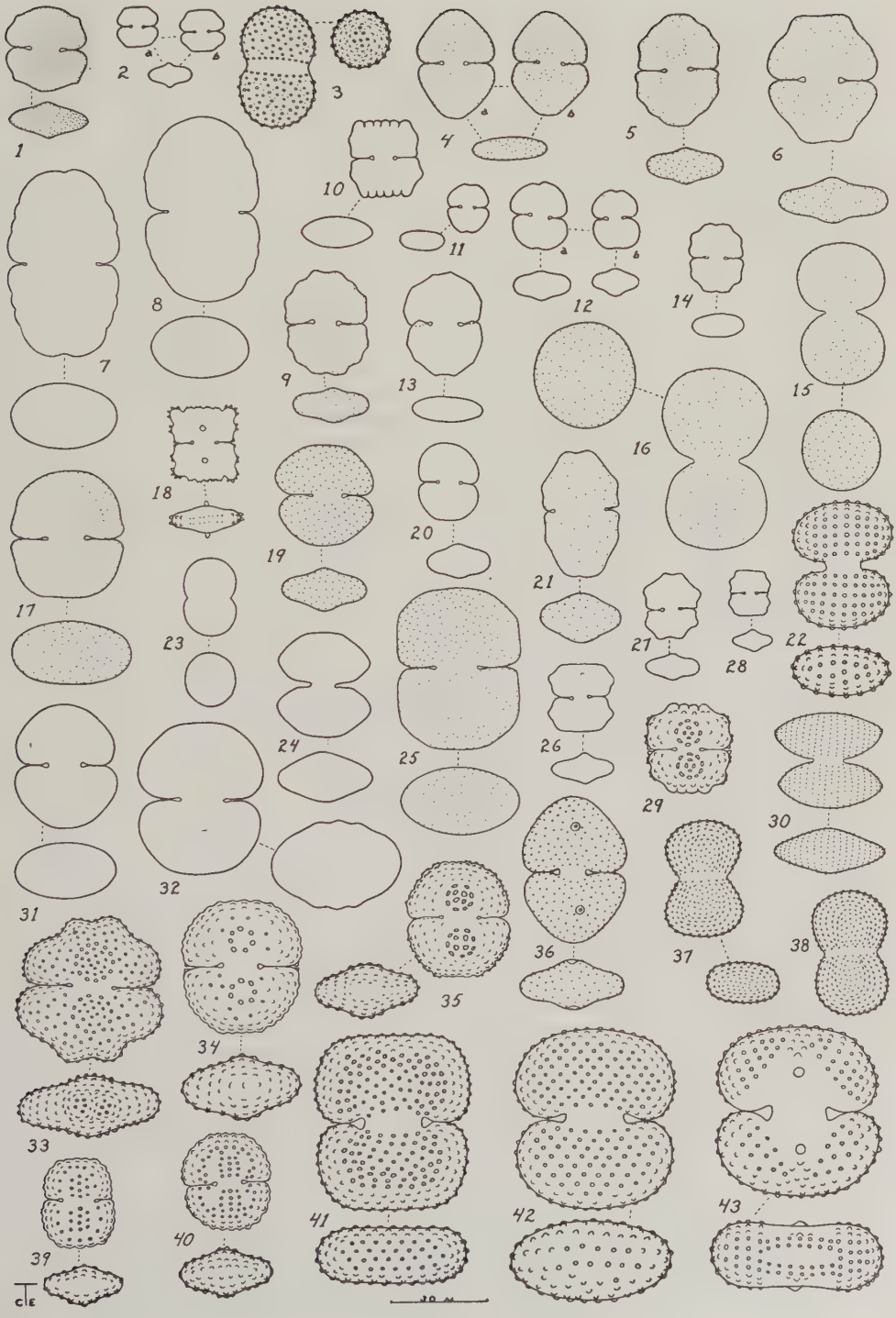
    This species was reported as being widely distributed in the Island Region by Pieters (1901) and Snow (1902). This has not been the case in the present survey where the writer has collected it only on Pelee Island.
12. *Cosmarium crenulatum* var. *tumidulum* Insam & Krieger (Pl. II, Fig. 35). Chloroplasts axial, with one pyrenoid. L. 15μ, w. 13μ, isth. 3–4μ. Exact locality unknown.

    Insam & Krieger (1936) give the dimensions of their specimens as 20.5 x 15.6 x 4.3μ. These are slightly larger than the dimensions of the present material. It should be compared to *Cos. perpusillum* West from which it differs by having more rounded apices instead of being retuse-truncate, and by its tumid vertical view.
13. *Cosmarium dentatum* Wolle (Pl. II, Fig. 34). Chloroplasts numerous, parietal, each with numerous pyrenoids. L. 115–142μ, w. 74–87μ, isth. 25–28μ. East Harbor.

    This is an extremely large species and exhibits more or less variation, especially in the number and prominance of the marginal teeth.
14. *Cosmarium depressum* (Naeg.) Lund. var. *achondrum* (Boldt) W. & G. S. West (Pl. II, Fig. 33). Cell wall finely punctulate; chloroplasts axial, with one pyrenoid. L. 33–43μ, w. 43–46μ, isth. 10–11μ. Wehrle.

EXPLANATION OF PLATE III

Fig. 1. *Cosmarium fontigenum.* Fig. 2. *Cosmarium geometricum* var. *suecicum.* 2a and 2b show slight variations in cell shape. Fig. 3. *Cosmarium globosum* var. *subaltum.* Fig. 4. *Cosmarium granatum.* 4a and 4b show slight variations in cell shape. Fig. 5. *Cosmarium granatum* var. *subgranatum.* Fig. 6. *Cosmarium hammeri* var. *protuberans.* Fig. 7. *Cosmarium holmiense.* Fig. 8. *Cosmarium holmiense forma?* Fig. 9. *Cosmarium impressulum* var. *suborthogona.* n. comb. Fig. 10. *Cosmarium humile* var. *striatum.* Fig. 11. *Cosmarium laeve.* Fig. 12. *Cosmarium laeve* var. *distentum forma?* 12a and 12b showing variations in size and shape. Fig. 13. *Cosmarium laeve* var. *octangulare.* Fig. 14. *Cosmarium meneghinii.* Fig. 15. *Cosmarium moniliforme* var. *punctata.* Fig. 16. *Cosmarium moniliforme* var. *subpyriforme.* Fig. 17. *Cosmarium nitidulum* var. *pseudovalidum* n. var. Fig. 18. *Cosmarium nobile.* Fig. 19. *Cosmarium phaseolus* var. *elevatum.* Fig. 20. *Cosmarium phaseolus forma minor?* Fig. 21. *Cosmarium pokornyanum.* Fig. 22. *Cosmarium portianum.* Fig. 23. *Cosmarium pseudarctoum.* Fig. 24. *Cosmarium pseudoprotuberans.* Fig. 25. *Cosmarium rectangulare.* Figs. 26, 27. *Cosmarium regnelli.* The two figures show extreme variations which may occur. Fig. 28. *Cosmarium regnelli* var. *minimum.* Fig. 29. *Cosmarium seelyanum.* Fig. 30. *Cosmarium subraciborskii* n. sp. Fig. 31. *Cosmarium subtumidum* var. *klebsii.* Fig. 32. *Cosmarium sulcatum* var. *sumatranum.* Fig. 33. *Cosmarium protractum.* Fig. 34. *Cosmarium punctulatum* var. *subpunctulatum.* Fig. 35. *Cosmarium subcostatum?* Fig. 36. *Cosmarium variolatum* var. *cataractarum.* Figs. 37, 38. *Cosmarium viride* var. *compressum* n. var. Two cells which vary in shape are figured. Fig. 39. *Cosmarium subcrenatum.* Fig. 40. *Cosmarium subcrenatum forma?* Fig. 41. *Cosmarium quadrum* var. *minus.* Fig. 42. *Cosmarium reniforme.* Fig. 43. *Cosmarium reniforme* var. *seminudum* var. nov.


1
2
a
b
3
4
a
b
5
6
7
8
9
10
11
12
a
b
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
CLE

15. *Cosmarium difficile* (Lutk.) var. *sublaeve* Schroeder (Pl. II, Fig. 36). Chloroplasts axial, with one pyrenoid. L. 21–26μ, w. 12–14μ, isth. 2–3μ. Kelleys Isl.

The Lake Erie material compares favorably with the figure of the variety given by Skuja (1928). Although he does not give the exact dimensions of the cells it would appear from the magnification that they are nearly the same. Dimensions of Michigan material reported by Prescott and Magnotta (1935) are somewhat greater.

16. **Cosmarium eriense** Taft n. sp. (Pl. II, Fig. 38). Cells of medium size, slightly longer than broad, deeply constricted, sinus linear, closed; semicells somewhat rectangular, each with a broad truncate lobe just below the apical angles, each lobe with a conical granule within the margin of the upper angle, apex truncate, upper lateral margins slightly retuse, basal angles broadly rounded, each furnished with a single medianly placed granule; vertical view ellipsoid with broadly rounded ends, each side with three undulations, four granules visible, one on either side near the ends. Cell wall indistinctly punctate. Chloroplasts single, axial, with one pyrenoid. L. 35–37μ, w. 30–33μ, isth. 11μ. Pelee.

Cellulae mediocres, paulo longiores quam latae, alte constrictae, sinu lineare clausoque; semicellulae eliquantum orthogoniae, quoque lobulum latum truncatum proxime infra angulos apicales praebente, omni lobulo granulum conicum in margine anguli superioris praebente, apex truncatus, margines laterales superiores aliquantum retusi, anguli basales late rotundati, quoque uno granulo, in medio locato, ornato; a vertice visae ellipticae, extremis late rotundatus, omni latere 3-undulato, quattiorgranuli aspectabiles, unus in utroque latere ad extrema. Nurus cellulae obscure punctatus. Chlorophyllaceae singulae, axiales, unum pyrenoidum praebentes. Long. 35–37μ, lat. 30–33μ, lat. isth. 11μ.

17. *Cosmarium exiguum* ? Arch. (Pl. II, Fig. 37). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 14–15μ, w. 7–8μ, isth. 6–7μ. Kelleys Isl.

18. *Cosmarium favum* West (Pl. IV, Fig. 1). Chloroplasts axial, with one pyrenoid. L. 62μ, w. 51μ, isth. 15μ. Kelleys Isl.

The lines delimiting the hexagonal areas are extremely delicate and may only be seen after critical lighting and focusing.

19. *Cosmarium fontigenum* Nordst. (Pl. III, Fig. 1). Cell wall finely punctulate; chloroplasts axial, with one pyrenoid. L. 22μ, w. 20–21μ, isth. 5–6μ. East Harbor.

It is almost a certainty that the writer passed over this small species in some of the earlier collections. Because of the curvature of the cells, the peculiar undulate character of the lateral margins is not readily evident when examining specimens, although the undulations are quite apparent in camera lucida figures.

20. *Cosmarium formulosum* Hof. (Pl. IV, Fig. 2). Chloroplasts axial, with two pyrenoids. L. 35–50μ, w. 32–42μ, isth. 9–13μ. Wehrle, Squaw Harbor.

21. *Cosmarium formulosum* forma? (Pl. IV, Fig. 3). L. 48–55μ, w. 44–48μ, isth. 11–13μ. Middle Isl.

Although the dimensions of this form intergrade with those of the species, the majority of the specimens are definitely larger. Otherwise the cells are similar.

22. **Cosmarium franzstonii** Taft n. sp. (Pl. IV, Fig. 4). Cells large, about one-fifth longer than broad, deeply constricted, sinus linear, closed; semicells ovate-pyramidate, apex slightly flattened, apical angles rounded; cell wall granulate with punctulations between the granules, granules near the apex large, becoming smaller and more numerous across the center and near the base of the semicell, center of semicell with two large protuberances which are evident because of their granulation; vertical view broadly elliptical with two large protuberances on either side, granules extending down to the protuberances larger than those in the center or at either end. Two massive chloroplasts in each semicell, each with one pyrenoid. L. 60–65μ, w. 50–55μ, isth. 16–20μ, thick 32μ. Gibraltar, Squaw Harbor, Middle Bass, Haunk, Kelleys Isl.

Cellulae magnae circa one-fifth longiores quam latae, late constrictae, sinu lineare clausoque; semicellulae ovato-pyramidatae, apex aliquantum complanatus, anguli apicales rotundati; murus cellulae granulatus, punctulationes inter granula habens, granula ad apicem magna, paullatim minores frequentioresque trans centrum et ad basam semicellulae. In centro semicellulae duae protuberationes magnae evidentes propter granu-

lationem; a vertice visae late ellipticae, duae protuberationes magnae in utroque aspectabiles, granulis in protuberationes maiores quam eae in centro aut in utroque extreme desuper patentibus. Duae chlorophyllaceae magnissimae in utraque semicellula, quaque unum pyrenoidum habente. Long. 60–65μ, lat. 50–55μ, lat. isth. 16–20μ.

The form of the semicells, the granulation, and the widely separated central protuberances separate it from *Cos. turpinii* and *Cos. didymoprotupsum.*

23. *Cosmarium geometricum* W. & G. S. West var. *suecicum* Borge (Pl. III, Fig. 2). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 12μ, w. 11μ, isth. 3μ. Kelleys Isl.

24. *Cosmarium globosum* Bulh. var. *subaltum* Messikommer (Pl. III, Fig. 3). Cell wall finely granulate; chloroplasts axial, with one pyrenoid. L. 35μ, w. 20μ, isth. 16μ Kelleys Isl.

This form was rarely found in the collections. It should be compared to *Cos. globosum* var. *granulatum* Schmidle and also with *Cos. trachypolum* West var. *aequaliter-granulata* Lutk. which has punctae between the granules.

25. *Cosmarium granatum* Bréb. (Pl. III, Fig. 4). Cell wall finely granulate; chloroplasts axial, with one pyrenoid. L. 23–27μ, w. 18–19μ, isth. 4–5μ. Haunk, Fisher, Smith, Squaw Harbor, Kelleys Isl., Pelee.

This highly variable species is widely distributed over the region. The lateral margins vary from strongly convex to strongly retuse, the latter condition being exemplified best by the individuals from Squaw Harbor. These might well be placed in the variety *concavum* Lagerh. which is considered as a local variation by some workers.

26. *Cosmarium granatum* var. *subgranatum* Nordst. (Pl. III, Fig. 5). Cell wall finely granulate, chloroplasts axial, with one pyrenoid. L. 25–29μ, w. 18–21u, isth. 4–5μ. Haunk, Fisher, Wehrle, Pelee.

27. *Cosmarium hammeri* Reinsch var. *protuberans* W. & G. S. West (Pl. III, Fig. 6). Cell wall finely punctate; chloroplasts axial, with one pyrenoid. L. 32–35μ, w. 25–29μ, isth. 8–10μ. Pelee.

28. *Cosmarium holmiense* Lund. (Pl. III, Fig. 7). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 50μ, w. 30μ, isth. 16μ. Kelleys Isl.

29. *Cosmarium holmiense* Lund. forma? (Pl. III, Fig. 8). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 48–50μ, w. 28–30μ, isth. 16μ. Kelleys Isl.

The dimensions and cell outline are almost exactly those of *Cos. holmiense* var. *trigonum* Nordst. The vertical view, however, is oval instead of triangular.

30. *Cosmarium impressulum* var. **suborthogona** (W. & G. S. West) Taft, new comb. (Pl. III, Fig. 9).

(*Cosmarium suborthogona* Racib., Desm. Nowe, 1889, p. 85, t. 5, fig. 29.)

(*Cosmarium impressulum* forma *suborthogona* W. & G. S. West, British Desmidiaceae, 1908, Vol. 3, p. 88.)

Cells rather small, nearly 1½ times as long as broad, constriction deep, closed, with a dilated apex; semicells subsemicircular, margin regularly eight-undulate, including basal angles, undulations equal, two at the apex and two on each side; vertical view elliptic, with a slight protuberance on each side near the middle; cell wall very finely punctulate; chloroplasts axial, with one pyrenoid. L. 25–27μ, w. 19–21μ, isth. 4–6μ. Haunk.

This desmid was first described by Raciborski as *Cos. suborthogona* and differed from *Cos. impressulum* only in the presence of the protuberances in vertical view. The Wests (1908) considered this to be an insufficient specific character, so placed it as *forma suborthogona* of *Cos. impressulum.* As the character appears to be constant, and as individuals have now appeared in widely separated areas, the writer gives it varietal rank.

31. *Cosmarium humile* (Gay) Nordst. var. *striatum* (Boldt) Schmidle (Pl. III, Fig. 10). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 16–19μ, w. 16–19μ, isth. 4μ. Wehrle, Haunk, Fisher, Smith, Squaw Harbor.

32. *Cosmarium kjellmani* Wille var. *grande* Wille (Pl. IV, Fig. 5). Chloroplasts axial, with two pyrenoids. L. 46–50μ, w. 37–39μ, isth. 11–13μ. Squaw Harbor, Dock at N. Bass.

33. *Cosmarium laeve* Raben. (Pl. III, Fig. 11). Cell wall appearing smooth, usually sparsely punctate, colorless; chloroplasts axial, with one pyrenoid. L. 13–14μ, w. 11–12μ, isth. 2–3μ. Squaw Harbor, East Harbor.

34. *Cosmarium laeve* var. *distentum* G. S. West forma? (Pl. III, Fig. 12). Chloroplasts axial, with one pyrenoid. L. 14–18μ, w. 11–15μ, isth. 3–4μ. Kelleys Isl., Beach pools on Middle Bass.

The cell outline is distinctly that of *Cos. laeve* but the vertical view is tumid. The specimens were somewhat smaller than those described by West, otherwise they were similar.

35. *Cosmarium laeve* var. *octangulare* (Wille) W. & G. S. West (Pl. III, Fig. 13). L. 26μ, w. 18μ, isth. 7μ. Pelee.

36. *Cosmarium lundellii* Delp. var. *ellipticum* West (Pl. IV, Fig. 6). Cell wall with small sparse granules; chloroplasts axial, ridged, with two pyrenoids. L. 69–87μ, w. 50–57μ, isth. 14–16μ. Fisher.

Although smaller, these cells slightly resemble *Cos. ochthodes* var. *aequalis* Insam & Krieger.

37. *Cosmarium margaritatum* (Lund.) Roy & Biss. (Pl. IV, Fig. 7). Chloroplasts axial, with two pyrenoids. L. 57–60μ, w. 46–48μ, isth. 18μ. Wehrle.

38. *Cosmarium meneghinii* Bréb. (Pl. III, Fig. 14). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 17–18μ, w. 11–14μ, isth. 3.5μ. Squaw Harbor, Beach pools on Middle Bass.

39. *Cosmarium moniliforme* (Turp.) Ralfs var. *punctata* Lagerh. (Pl. III, Fig. 15). Cell wall finely punctulate; chloroplasts axial, with about 6–7 radiating plates, one pyrenoid. L. 37–41μ, w. 23μ, isth. 7μ. East Harbor.

40. *Cosmarium moniliforme* var. *subpyriforme* W. & G. S. West (Pl. III, Fig. 16). Cell wall finely punctulate; chloroplasts with 10–11 flanges, one pyrenoid. L. 44–48μ, w. 25–28μ, isth. 11–12μ. Pelee.

In the original description of this variety only one set of dimensions is given. Unless the Wests' material was extremely constant, they saw only one specimen. While the dimensions of the Lake Erie material are distinctly greater, the writer feels that they possibly exhibit the upper limits of the size range. Material from Arkansas, collected by Couch (unpublished) is decidedly smaller, the dimensions being 35 x 20 x 6μ.

41. *Cosmarium nitidulum* De Not. var. **pseudovalidum** Taft n. var. (Pl. III, Fig. 17). Cells slightly longer than broad, deeply constricted, sinus linear; semicells subrectangular, basal angles nearly rectangular, more or less produced, upper angles broadly rounded, apex truncate-convex. Vertical view elliptic. Cell wall punctate. Chloroplasts axial, with one pyrenoid. L. 33–35μ, w. 28–30μ, isth. 6–7μ. Kelleys Isl.

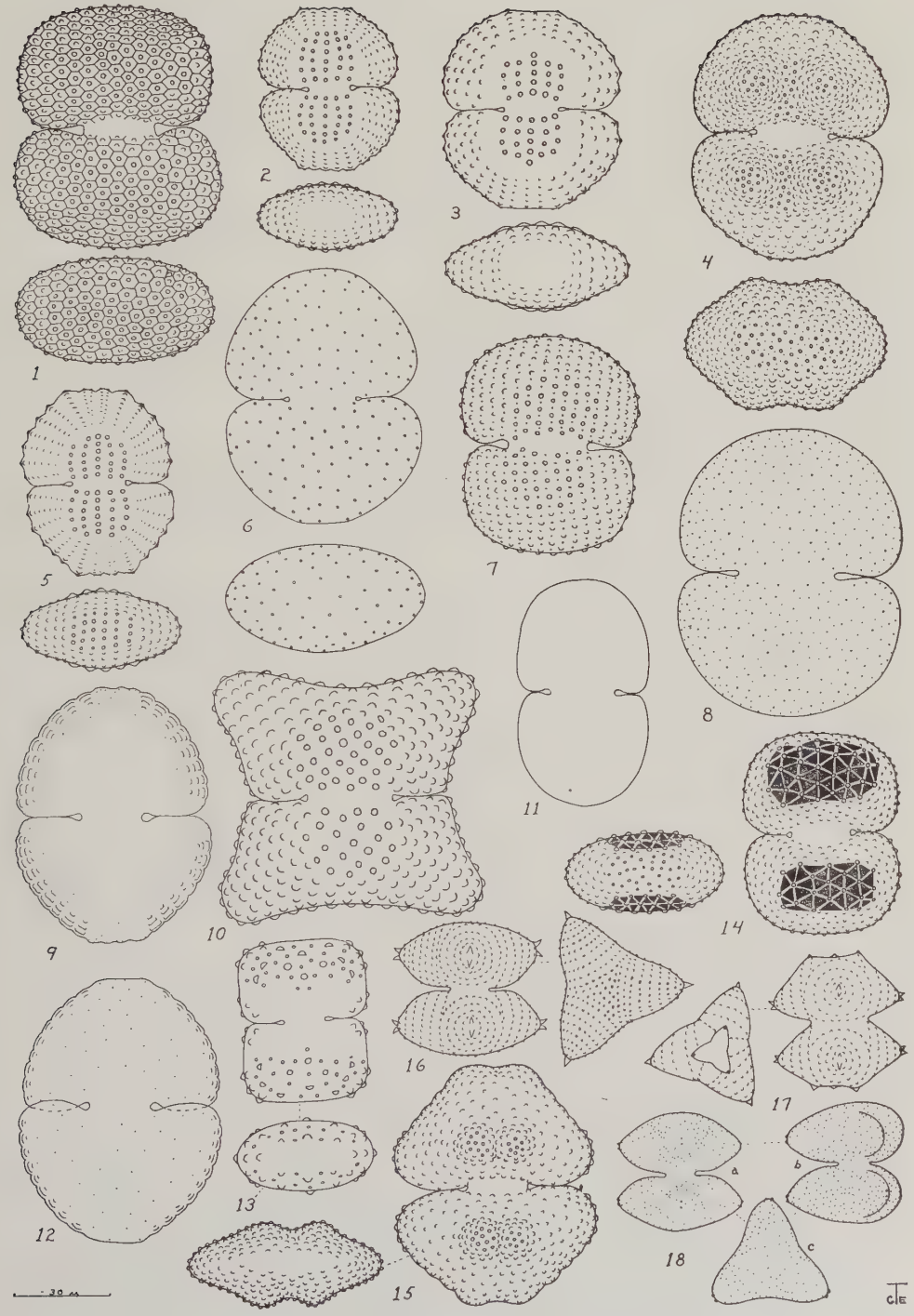
C. medio sinu lineare profundo constrictum; semicellulis transverse subrectangularis, diametro maximo paullo supramedio, angulis inferioribus obtusis rotundatis, angulis superioribus late rotundatis, apicibus truncatis vel convexis; cellulis a vertice ellipticis. Membrana distincte punctata. Pyrenoides singuli. Long. 33–35μ, lat. 28–30μ; lat. isth. 6–7μ.

This variety is separated from *Cos. nitidulum* because of the rectangular or produced basal angles. In this respect it resembles *Cos. pseudonitidulum* var. *validum*. It differs from this variety by its smaller dimensions and the presence of only one pyrenoid in each chloroplast, the latter being a distinctive character of *Cos. nitidulum*.

42. *Cosmarium nobile* (Turner) Krieger (Pl. III, Fig. 18). This species was incompletely described as a species of *Euastrum* by Turner (1892) from notes left by Dr. Wallich.

EXPLANATION OF PLATE IV

Fig. 1. *Cosmarium favum*. Fig. 2. *Cosmarium formulosum*. Fig. 3. *Cosmarium formulosum forma?* Fig. 4. *Cosmarium franzstonii* n. sp. Fig. 5. *Cosmarium kjellmani* var. *grande*. Fig. 6. *Cosmarium lundellii* var. *ellipticum*. Fig. 7. *Cosmarium margaritatum*. Fig. 8. *Cosmarium pachydermum* var. *aethiopicum*. Fig. 9. *Cosmarium ochtodes*. Fig. 10. *Cosmarium porrectum*. Fig. 11. *Cosmarium subcucumis*. Fig. 12. *Cosmarium subochthodes*. Fig. 13. *Cosmarium triplicatum*. Fig. 14. *Cosmarium subnudiceps* var. *granulatum* n. var. Fig. 15. *Cosmarium turpinii* var. *podolicum*. Fig. 16. *Staurastrum avicula* var. *subarcuatum*. Fig. 17. *Staurastrum biarcuus* n. sp. Fig. 18a, b, c. *Staurastrum bieneanum*. Figs. 18a and b are face views of the cell from different angles; 18c is the end view.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
a
b
c
30 μ
CE

Krieger (1937) has referred it to the genus *Cosmarium*. In the original description Turner states, "A vertice et a latere non cl. Wallichio observatum" and "Judging from the drawing it appears to have one amylum-corpuscle (large) in each semicell."

The vertical view as figured by the writer, is elliptic with slight tumid areas on either side, each having a distinct conical granule. This granule is also evident in face view and may be the "One amylum-corpuscle" referred to in Turner's description, although it is much smaller than the structure shown in his figure. If his statement "one amylum-corpuscle" does refer to the pyrenoid, then there is some discrepancy as the present material shows two pyrenoids. L. 17–18μ, w. 17–18μ, isth. 4μ. Haunk.

43. *Cosmarium ochtodes* Nordst. (Pl. IV, Fig. 9). Cell wall punctate within the marginal crenations; chloroplasts axial, with two pyrenoids. L. 67–74μ, w. 50–55μ, isth. 14–16μ. Pelee, Kelleys Isl.
44. *Cosmarium pachydermum* Lund var. *aethiopicum* W. & G. S. West (Pl. IV, Fig. 8). Cell wall punctate, punctae interspersed with very fine punctulations; chloroplasts axial, with two pyrenoids. L. 78–83μ, w. 62μ, isth. 27–30μ. Pelee.
45. *Cosmarium phaseolus* Bréb. var. *elevatum* Nordst. (Pl. III, Fig. 19). Cell wall smooth, colorless; chloroplasts axial, with one pyrenoid. L. 23–25μ, w. 21–23μ, isth. 4–5μ. East Harbor, Squaw Harbor, Haunk, Wehrle.
46. *Cosmarium phaseolus* forma *minor?* Boldt. (Pl. III, Fig. 20). Cell wall smooth, colorless; chloroplasts axial, with one pyrenoid. L. 17–20μ, w. 16μ, isth. 4μ. Fisher, Pelee.

The shape of the semicells of this form is almost exactly that of *Cos. phaseolus* var. *rectangulare* Insam & Krieger (1936) but the dimensions are about half those of this variety. In size and cell outline it is very near forma *minor* Boldt as figured by Skuja (1928) and Irenee-Marie (1938).

47. *Cosmarium pokornyanum* (Grun.) W. & G. S. West (Pl. III, Fig. 21). Cell wall sparsely punctate; chloroplasts axial, with one pyrenoid. L. 33–35μ, w. 18–19μ, isth. 10–11μ. Kelleys Isl.

This species should be compared with *Cos. laeve* var. *septentrionale* Wille from which it differs by having a rhomboid-ovoid vertical view and a shallow sinus.

48. *Cosmarium porrectum* Nordst. (Pl. IV, Fig. 10). Cell wall with minute pores between the granules; chloroplasts axial, each with one pyrenoid. L. max. 64–73μ, l. min. 57–62μ, w. max. 69–83μ, w. min. 51–57μ, isth. 21–23μ. East Harbor.
49. *Cosmarium portianum* Arch. (Pl. III, Fig. 22). Chloroplasts axial, with one pyrenoid. L. 33–37μ, w. 24–27μ, isth. 9–10μ. East Harbor.
50. *Cosmarium protractum* (Naeg.) De Bary (Pl. III, Fig. 33). Chloroplasts axial, with two pyrenoids. L. 33–46μ, w. 30–37μ, isth. 9–10μ. Haunk, East Harbor.
51. *Cosmarium pseudarctoum* Nordst. (Pl. III, Fig. 23). Cell wall smooth, colorless; chloroplasts axial, with about 4–5 radiating plates and one pyrenoid. L. 19–20μ, w. 14μ, isth. 10–11μ. Kelleys Isl.
52. *Cosmarium pseudoprotuberans* Kirchn. (Pl. III, Fig. 24). Cell wall appearing smooth, but with very fine punctulations; chloroplasts axial, with one pyrenoid. L. 25–27μ, w. 23–24μ, isth. 5–6μ. East Harbor.
53. *Cosmarium punctulatum* Bréb. var. *subpunctulatum* (Nordst.) Borges (Pl. III, Fig. 34). Chloroplasts axial, with one pyrenoid. L. 32μ, w. 30μ, isth. 7μ. Kelleys Isl.
54. *Cosmarium quadrum* Lund. var. *minus* Nordst. (Pl. III, Fig. 41). Chloroplasts axial, with two pyrenoids. L. 44μ, w. 35μ, isth. 14μ. Haunk.
55. *Cosmarium rectangulare* Grun. (Pl. III, Fig. 25). Cell wall punctate; chloroplasts axial, with one pyrenoid. L. 42–44μ, w. 34–35μ, isth. 11–12μ. Pelee.
56. *Cosmarium regnelli* Wille (Pl. III, Figs. 26, 27). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 17–18μ, w. 14–17μ, isth. 4–5μ. Smith, Wehrle, Fisher.

Figure 26 is that of *Cos. regnelli* Wille, while Figure 27 illustrates one of the more extreme variations. In all cases the Lake Erie material possessed a tumid vertical view, a condition which has not been generally reported. However the figures of this species by Insam and Krieger (1936) show the vertical view as either elliptic or tumid. Since this character is used in distinguishing varieties of other species, future studies may result in the segregation of a variety on the basis of the tumid condition.

57. *Cosmarium regnelli* var. *minimum* Eichl. et Gutw. (Pl. III, Fig. 28). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 11–14μ, w. 11–12μ, isth. 3–4μ. Wehrle.

Specimens of this variety, as in the species, were tumid in vertical view. They resemble closely the figure given by Messikommer (1935).

58. *Cosmarium reniforme* (Ralfs) Arch. (Pl. III, Fig. 42). Chloroplasts axial, with two pyrenoids. L. 48μ, w. 44μ, isth. 14μ. Haunk.

59. *Cosmarium reniforme* var. **seminudum** Taft n. var. (Pl. III, Fig. 43). Semicells granulate only in upper part, granules extending in oblique series from near the basal angles to the middle of the apex, from which a granulate area extends downward nearly to the center of the semicell which is furnished with one large conical granule, cell otherwise not granulate; vertical view oblong-rectangular with broadly rounded ends, lateral margins slightly concave with one large granule on either side, ends with six or seven rows of granules, these granulate areas being connected by two separate series of two or three rows of granules across the end of the cell, median portion of vertical view without granules. L. 46–48μ, w. 41μ, isth. 14μ. Squaw Harbor.

Semicellulae granulatae solum in parte superiore, granuli in serie obliqua de loco propter angulos basales ad medium apicem, a quo area granulata prope ad centrum semicellulae, uno granulo magno conico praeditae, desuper patet, cellula aliter non granulata; a vertice visae oblongo-orthogoniae, extremis late rotundatis, margines laterales aliquantum concavi, unum granulum magnum in utroque latere haventes, in sex aut septem ordines granulorum desinit, his granulis duabus seriebus separatis duorum aut trium ordinum granulorum trans extremum cellulae inter se conjunctis, pars media a vertice visa sine granulis. Long. 46–48μ, lat. 41μ, lat. isth. 14μ.

60. *Cosmarium seelyanum* Wolle (Pl. III, Fig. 29). Chloroplasts axial, with one pyrenoid. L. 23μ, w. 23μ, isth. 6–7μ. East Harbor.

The original figure and description of this species (Wolle, 1884) shows the upper angles of the semicells to be slightly more produced and the dimensions of the cells a little greater than in the Lake Erie material. Otherwise they are comparable.

61. *Cosmarium subcostatum?* Nordst. (Pl. III, Fig. 35). Chloroplasts axial, with one pyrenoid. L. 32μ, w. 27μ, isth. 7μ. Middle Isl.

The original figure of this species by Nordstedt (1876) shows a curved row of granules just below the granulate central protuberance. Later figures by other workers do not always show this row of granules. As the writer did not see enough of this material to determine the variations, it has been doubtfully assigned to this species.

62. *Cosmarium subcrenatum* Hantzsch (Pl. III, Fig. 39). Chloroplasts axial, with one pyrenoid. L. 23μ, w. 19μ, isth. 7μ. Kelleys Isl.

63. *Cosmarium subcrenatum* forma? (Pl. III, Fig. 40). Chloroplasts axial, with one pyrenoid. L. 21–25μ, w. 19–23μ, isth. 5–6μ. Squaw Harbor.

64. *Cosmarium subcucumis* Schmidle (Pl. IV, Fig. 11). Cell wall smooth; chloroplasts axial, with two pyrenoids. L. 55–60μ, w. 35–37μ, isth. 14–19μ. Kelleys Isl., Pelee.

65. *Cosmarium subnudiceps* West & West var. **granulatum** Taft n. var. (Pl. IV, Fig. 14). Cell wall densely granulate, granules not arranged in series. L. 50–54μ, w. 41–43μ, isth. 10–11μ. Kelleys Isl., Pelee, East Harbor.

Membrana granulata, granulis non regulariter ordinatis. Long. 50–54μ, lat. 41–43μ, isth. 10–11μ.

This variety differs from the species by having the cell wall which borders the sculptured areas covered with small granules. The dimensions are also somewhat greater.

66. *Cosmarium subochthodes* Schmidle (Pl. IV, Fig. 12). Cell wall with small granules; chloroplasts two, axial, each with one pyrenoid. L. 64μ, w. 50μ, isth. 16μ. Haunk.

67. **Cosmarium subraciborskii** Taft n. sp. (Pl. III, Fig. 30). Cells slightly broader than long, deeply constricted, sinus open; semicells transversely elliptic to nearly fusiform, lateral angles sharply rounded; cell wall minutely granulate, granules arranged in 18–20 vertical series across each semicell; vertical view narrowly elliptic with a slight median protuberance on either side, ends sharply rounded; a single chloroplast with one pyrenoid in each semicell. L. 23–27μ, w. 25–30μ, isth. 5–7μ. Squaw Harbor, Kelleys Isl., East Harbor.

C. paullo latius quam longius, profundo sinu ampliato constrictum; semicellulis transversis ellipticis vel fere fusiformis, angulis lateribus acutis rotundatis; membrana granulis (Verrucis minutis) in 18–20 series perpendiculares ordinatis. Semicellulae a vertice aspectae ellipticae medio utrimque tumidae. Massa chlorophyllacea singulae, pyrenoidae singulae. Long. 23–27μ; lat. 25–30μ, lat. isth. 5–7μ.

In general appearance this species stands near *Cos. raciborskii*. However its dimensions are only slightly more than one-half those of Lagerheim's species. The granulation is in distinct vertical series while that of *Cos. raciborskii* is described as "series oblique desussatas regulariter." Differences are also apparent in vertical view in which the Lake Erie material exhibits slight but distinct median protuberances and sharply rounded ends.

68. *Cosmarium sulcatum* Nordst. var. *sumatranum* Schmidle (Pl. III, Fig. 32). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 39μ, w. 29–32μ, isth. 9μ. Kelleys Isl.

The dimensions of the present material are somewhat greater than those given by Schmidle (1895). Otherwise the material is comparable.

69. *Cosmarium subtumidum* Nordst. var. *klebsii* (Gutw.) W. & G. S. West (Pl. III, Fig. 31). Cell wall smooth to very finely punctulate; chloroplasts axial, with one pyrenoid. L. 32μ, w. 25–28μ, isth. 7–9μ. Squaw Harbor.

70. *Cosmarium triplicatum* Wolle (Pl. IV, Fig. 13). Chloroplasts axial, with two pyrenoids. L. 44–46μ, w. 36–37μ, isth. 11–12μ. East Harbor, Kelleys Isl.

The original figure of this species by Wolle (1884) left much to the imagination concerning the central granulation. It was not until West (1898) had examined and figured numerous specimens from various parts of the United States that the true nature of the cell wall was recognized.

71. *Cosmarium turpinii* Bréb. var. *podolicum* Gutw. (Pl. IV, Fig. 15). Chloroplasts axial, with two pyrenoids. L. 57–64μ, w. 50–53μ, isth. 12–14μ. Wehrle, Fox, Fisher, Pelee.

This variety is rather widely distributed in the Island Region. The specimens from Pelee Island had a flat granulate apex and very slight double tumers.

72. *Cosmarium variolatum* Lund. var. *cataractarum* Racib. (Pl. III, Fig. 36). Chloroplasts axial, with one pyrenoid. L. 37–43μ, w. 25–30μ, isth. 6–7μ. Fisher, Wehrle, Squaw Harbor, Gibraltar, Kelleys Isl.

The lateral margins of the semicells vary from convex to retuse, although usually straight or convex. It should be compared to *Cos. granatum* var. *oscellatum* G. S. West which is not tumid in vertical view.

73. *Cosmarium viride* (Corda) Josh. var. **compressum** Taft n. var. (Pl. III, Figs. 37, 38). Cells rather small, slightly constricted, sinus obtuse; semicells obovate-circular with slightly depressed apices. Vertical view compressed circular. Cell wall finely but distinctly granulate, granules arranged in concentric rows within the margins of the semicells. Chloroplasts axial, with one pyrenoid. L. 30–32μ, w. 18–22μ, isth. 12–14μ. Kelleys Isl.

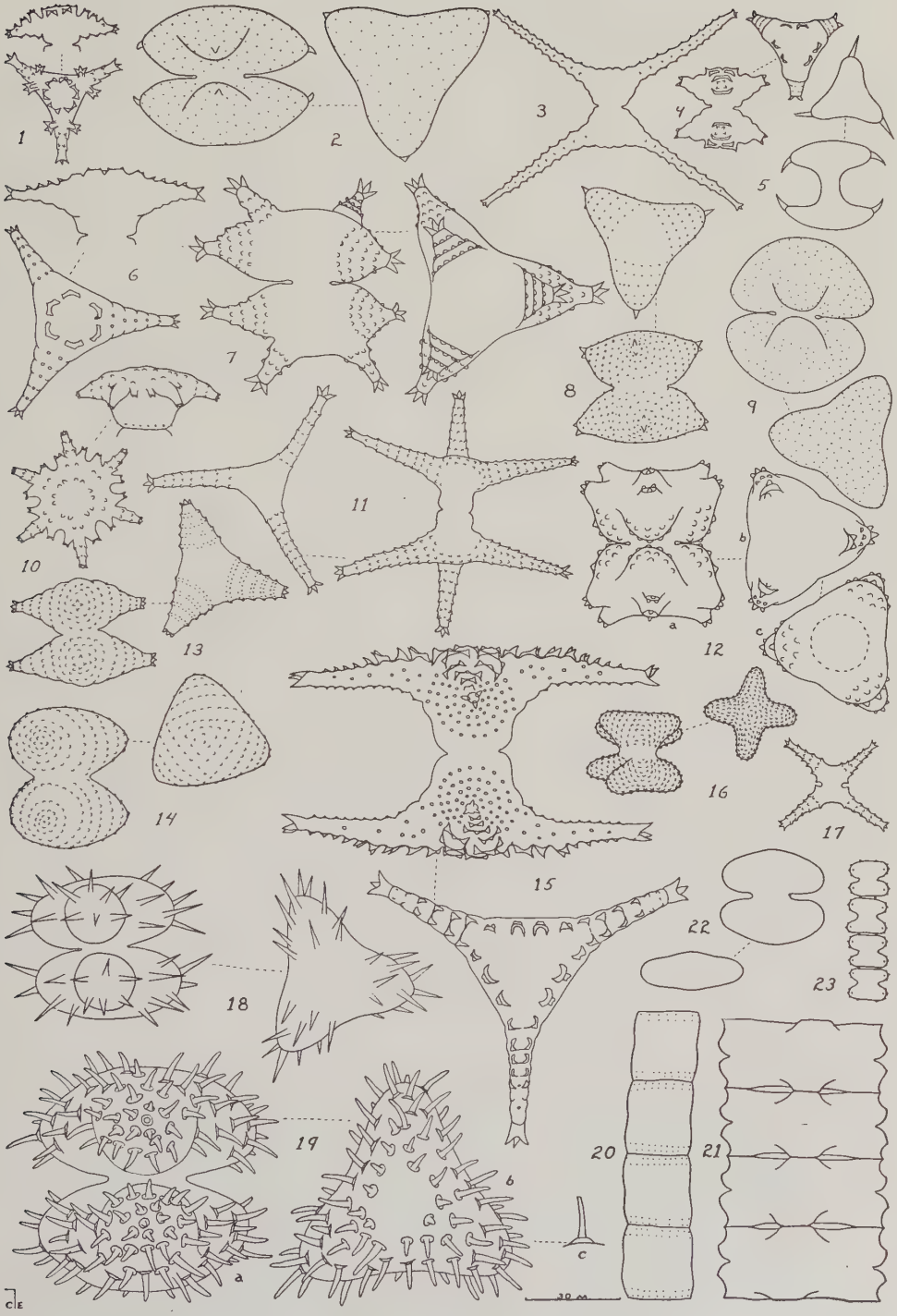
Semicellulis depressis obovatis-circularis; a vertice aspectis compressis circularis. Membrana granulis minutis, in series concentricas dispositis praedita. Long. 30–32μ; lat. 18–22μ; lat. isth. 12–14μ.

Because of an inadequate description, the identity of *Colopelta viridis* Corda remains

---

EXPLANATION OF PLATE V

Fig. 1. *Staurastrum bicoronatum* var. *tridentatum* n. var. Fig. 2. *Staurastrum brevispinum* var. *canadense* n. var. Fig. 3. *Staurastrum chaetoceras*. Fig. 4. *Staurastrum crenulatum*. Fig. 5. *Staurastrum cuspidatum*. Fig. 6. *Staurastrum floriferum?* Fig. 7. *Staurastrum furcigerum*. Fig. 8. *Staurastrum granulosum*. Fig. 9. *Staurastrum orbiculare*. Fig. 10. *Staurastrum ornatum* var. *asperum*. Fig. 11. *Staurastrum paradoxum*. Fig. 12a, b, c. *Staurastrum peleii* n. sp. 12a, face view; 12b, upper surface of semicell; 12c, lower surface of semicell. Fig. 13. *Staurastrum polymorphum*. Fig. 14. *Staurastrum punctulatum* var. *kjellmanii*. Fig. 15. *Staurastrum sebaldi* var. *ornatum*. Fig. 16. *Staurastrum striolatum*. Fig. 17. *Staurastrum tetracerum*. Fig. 18. *Staurastrum setigerum*. Fig. 19a, b, c. *Staurastrum polytrichum* var. *ornatum*. n. var. Fig. 19a, face view; 19b, end view; 19c, detail of spine. Fig. 20. *Hyalotheca mucosa*. Fig. 21. *Desmidium swartzii*. Fig. 22. *Spondylosium luetkemulleri?* Fig. 23. *Sphaerozosma granulatum*.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
a
b
c

somewhat questionable. Joshua (1885) discovered a plant from Pictou, Nova Scotia, which he referred to Corda's species and included it in the genus *Cosmarium*. His figure indicates that the wall was punctate. Turner, during the same year (1885), reported *Cosmarium cordanum* Bréb. from Nova Scotia. This was the same desmid as reported by Joshua as *Cos. viridis* (Corda) but in his description Turner states "Cell-coat lightly granular or punctate. End view circular." The West's in their British Desmidiaceae (1908) report the species and a forma *minor* West. Again the cell wall is described as punctate. The dimensions of West's forma *minor* are almost exactly those of the present material while in all recorded cases those of the species are distinctly greater. Also the vertical view of the species as well as of West's forma *minor* has been consistently reported as circular while the Ohio material is consistently compressed. Because of these differences the Lake Erie material has been given varietal rank.

Staurastrum Meyen 1829

Cells of variable size, usually as broad or broader than long, usually radially symmetrical, median constriction more or less deep; semicells variable in outline, with the angles frequently produced into elongate, hollow processes, 2–12 radiate in vertical view; cell wall smooth to granulate, or with variously arranged spines or verrucae; chloroplasts one per semicell, axial, with radiating lobes, and one pyrenoid.

1. *Staurastrum avicula* Bréb. var. *subarcuatum* (Wolle) W. West (Pl. IV, Fig. 16). L. 36–37μ, w. 38–40μ, isth. 9–10μ. Wehrle.
2. **Staurastrum biarcuus** Taft n. sp. (Pl. IV, Fig. 17). Semicells truncate- pyramidate, base convex, apex retuse, sides straight, sinus deep, rapidly opening outward; cell wall granulate, granules arranged in concentric series about the angles; each basal angle furnished with two vertically arranged teeth, the lower somewhat smaller than the one above; each apical angle furnished with a single, broad, conical granule. Vertical view triangular; each angle exhibiting a single tooth-like granule; sides straight or slightly convex, sharply retuse at the center. Within the vertical view formed by the basal angles, and an exact miniature, is the smaller vertical view of the apical angles. L. 35–36μ, w. 32–34μ, isth. 14μ. Kelleys Isl.

   Semicellulae truncato-pyrimidatae, basis convexa, apex retuses, lateres recti; sinus altus, rapide extra se pandens; murus cellulae granulatus, granulis in seriebus concentricis circum angulos dispositis; omnis angulus basalis duobus dentibus a vertice positis praeditus, inferiore paulo minore quam superiore; omnis angulus apicalis granulo singulo, lato, conicoque praeditus. A vertice visae triangulae; omnis angulus granulum singulum denti simile praebens; lateres recti aut aliquantum convexi, acute retusi ad centrum. In apsectu a vertice angulis basalicibus facto, et tabella minuta exacta, est aspectus minor a vertice angulorum apicalum. Long. 35–36μ, lat. 32–34μ, lat. isth. 14μ.

   This species should be compared to *St. paniculosum* Wolle which has two small teeth at the end of each basal angle. It differs from Wolle's species in its open instead of a closed sinus, the presence of granules on the upper angles, and the retuse sides in vertical view.
3. *Staurastrum bicoronatum* Johnson var. **tridentatum** Taft n. var. (Pl. V, Fig. 1). Apex of semicells distinctly elevated; each lateral process in vertical view with three short spines. L. 23μ, w. 38–43μ, isth. 4–6μ. East Harbor.

   Varietas type paullo major; semicellulis apicibus convexis; a vertice aspectae processibus lateralis cum tres spinis brevis. Long. 23μ; lat. 38–43μ; lat. isth. 4–6μ.

   This variety differs from the species by having three short instead of two long spines terminating each lateral process. The dimensions are also somewhat greater while the apex of the semicell is more convex. It differs from the variety described by West (1896) by having more ornamentations, and especially by the presence of the circularly arranged verrucae around the apex.
4. *Staurastrum bieneanum* Raben. (Pl. IV, Fig. 18). Cell wall finely granulate, two larger granules at each angle. L. 31–32μ, w. 30–34μ, isth. 7–8μ. Kelleys Isl.
5. *Staurastrum brevispinum* Bréb. var. **canadense** Taft n. var. (Pl. V, Fig. 2). This variety

differs from the species by having depressed-hexagonal semicells with rather acute lateral angles. Cell wall obscurely granulate. L. 46–48μ, w. 44μ, isth. 9–10μ. Pelee.

Haec varietas differt a typo semicellulis depresso-hexagonis, angulis lateralibus acutis. Membrana granulata obscure. Long. 46–48μ; lat. 44μ; lat. isth. 9–10μ.

6. *Staurastrum chaetoceras* (Schroeder) G. M. Smith (Pl. V, Fig. 3). L. plus processes 40–75μ, l. minus processes 18–25μ, w. plus processes 60–73μ, w. minus processes 14–16μ, isth. 4–7μ. Hatchery Bay.
7. *Staurastrum crenulatum* Delp. forma? (Pl. V, Fig. 4). L. 21μ, w. 23μ, isth. 5μ. Wehrle.
8. *Staurastrum cuspidatum* Bréb. (Pl. V, Fig. 5). L. 18–20μ, w. minus spines 16–18μ, isth. 4–5μ. Smith.
9. *Staurastrum floriferum* ? W. & G. S. West (Pl. V, Fig. 6). L. 34–46μ, w. plus processes 48–50μ, isth. 7–9μ. Wehrle, Smith, Haunk.

   The original figure of this species by West (1895) illustrates a specimen which was much less robust than any seen by the writer. The sculpturing of the wall, however, is nearly identical.
10. *Staurastrum furcigerum* Bréb. (Pl. V, Fig. 7). L. minus processes 41μ, w. plus processes 55–57μ, isth. 13u. Pelee.
11. *Staurastrum granulosum* (Ehren.) Ralfs (Pl. V, Fig. 8). L. 27–32μ, w. 25–32μ, isth. 10–14μ. Kelleys Isl.
12. *Staurastrum orbiculare* Ralfs var.? (Pl. V, Fig. 9). L. 42μ, w. 40μ, isth. 11μ. Pelee.
13. *Staurastrum ornatum* Turner var. *asperum* (Perty) Schmidle (Pl. V, Fig. 10). L. 26–28μ, w. 37μ, isth. 8–10μ. Pelee, East Harbor.
14. *Staurastrum paradoxum* Meyen (Pl. V, Fig. 11). L. minus processes 28–29μ, w. plus processes 53u, w. minus processes 12–15μ, isth. 7μ. Hatchery Bay.
15. **Staurastrum peleii** Taft n. sp. (Pl. V, Fig. 12). Cells of medium size, square or slightly rectangular in face view; sinus deep and closed; semicells horizontally rectangular, with three apical angles continued into two short, truncate, vertically arranged processes, basal angles broadly rounded and furnished with three concentric rows of granules, three granules of which show along each margin; vertical view of semicell triangular, each angle which represents the basal angle of the semicell broadly rounded, superimposed and projecting beyond this angle is the lower of the two vertically arranged processes, bearing at the margin three conical teeth and a row of three smaller granules within the margin, within this process is a bidentate protuberance corresponding to the upper of the two vertically arranged processes; basal view of the semicell triangular, angles broadly rounded, the margins furnished with one (rarely two) large conical teeth and two smaller granules on either side, and with two concentric rows of granules within the margin of either angle; sides in vertical view sharply retuse at the center. L. 37–39μ, w. 37–39μ, isth. 16μ. Pelee.

    Cellulae mediocres, quadratae aut aliquantum orthogoniae a fronte visae, sinu alto clausoque; semicellulae ad libram orthogoniae, tribus angulis apicales in dua prominentia brevia, truncata, a vertice disposita extentis, anguli basales late rotundati, tribus ordinibus concentricis granulorum praediti, ex quibus tria granula secundum utrumque marginem videri possunt; semicellula a vertice visa triangula, omne angulo, qui est idem cum angulo basale semicellulae, late rotundato, superimpositum et trans hunc angulum projectum est superius duorum prominentium a vertice dispositorum, tres dentes conicos et ordinem trium granulorum minorum in margine gerens, in hoc prominente est protuberatio bidentata superiori duorum prominentium a vertice dispositorum par; semicellula a basi visa triangula anguli late rotundati, margines uno aut raro duobus dentibus magnis conicisque et duobus granulis minoribus in utroque latere et duobus ordinibus concentricis granulorum in margine utrique anguli ornati, lateris a vertice visi in centro acute retusi. Long. 37–39μ, lat. 37–39μ, lat. isth. 16μ.
16. *Staurastrum polymorphum* Bréb. (Pl. V, Fig. 13). L. 28–30μ, w. 35–46μ, isth. 7–9μ. Haunk, Squaw Harbor, East Harbor.
17. *Staurastrum polytrichum* Perty var. **ornatum** Taft n. var. (Pl. V, Fig. 19). Cells slightly longer than broad, apices truncate instead of rounded; spines mostly curved, attached to

truncate, conical protuberances of the wall. Otherwise as in the species. L. minus spines 58μ, w. minus spines 55–57μ, w. plus spines 66–67μ, isth. 21μ, spines 4.5–5.5μ. Pelee.

Cellulae paulo longiores quam latae, apices truncati, non rotundati; spinae plerumque curvatae, protuberationibus truncatis conicisque muri aptae. Long. 58μ, lat. 66–67μ, lat. isth. 21μ.

18. *Staurastrum punctulatum* Bréb. var. *kjellmanii* Wille (Pl. V, Fig. 14). L. 39μ, w. 30μ, isth. 13μ. Kelleys Isl.
19. *Staurastrum sebaldi* Reinsch var. *ornatum* Nordst. (Pl. V, Fig. 15). L. 53μ, w. plus processes 96μ, w. minus processes 21μ, isth. 14μ. East Harbor.
20. *Staurastrum setigerum* Cleve (Pl. V, Fig. 18). L. 35–39μ, w. 39–46μ, isth. 11μ. Squaw Harbor, Wehrle, Haunk.

Somewhat smaller than usual, but with the typical arrangement of spines.

21. *Staurastrum striolatum* (Naeg.) Arch. (Pl. V, Fig. 16). L. 19–21μ, w. 18–23μ, isth. 8μ. Wehrle, Haunk, Smith, Kelleys Isl.
22. *Staurastrum tetracerum* Ralfs (Pl. V, Fig. 17). L. plus processes 25–27μ, l. minus processes 10–11μ, w. plus processes 28–30μ, w. minus processes 7–9μ, isth. 5μ. East Harbor.

Sphaerozosma Corda 1835

Cells small, flattened, deeply constricted, with an open sinus, united in long, twisted filaments by means of short apical appendages. One chloroplast and one pyrenoid in each semicell.

1. *Sphaerozosma granulatum* Roy & Biss. (Pl. V, Fig. 23). Cell length 9–10μ, w. 9–11μ, isth. 4–5μ. Smith.

Spondylosium Bréb. 1844

Cells flattened, often deeply constricted, sinus open, variable in shape, apices truncate, concave or convex. Vertical view elliptic, tumid-elliptic or triangular. Cells united by the apposition of the apices into filaments.

1. *Spondylosium luetkemuelleri?* Grönblad. (Pl. V, Fig. 22). Cells of medium size, deeply constricted, sinus open. Vertical view elliptic, slightly tumid on either side. Cell wall smooth. Chloroplasts axial, each with one pyrenoid.

These specimens have been doubtfully referred to *Spondylosium luetkemuelleri* on the basis of cell shape, size and chloroplast structure. Only two cells were seen and they were not united. Such peculiar shaped cells, if united in filaments, would dissociate readily. This may have happened in the writers collections.

Hyalotheca Ehren. 1840

Cells nearly cylindrical, length and breadth about the same, constriction broad and shallow, united into long filaments which are enclosed by a gelatinous sheath; each semicell with one axial chloroplast having radiating ridges and one pyrenoid.

1. *Hyalotheca mucosa* (Mert.) Ehr. (Pl. V, Fig. 20). Cell wall with two parallel rows of granules just within the apices. Filaments usually enclosed within a broad gelatinous sheath. Cell length 16–21μ, w. 18–20μ, isth. 16–18μ. East Harbor.

Desmidium Ag. 1824

Cells united in twisted filaments, usually with a broad gelatinous sheath, depressed, broader than long, with a distinct median constriction; 3–4 angled in vertical view (sometimes ovoid or citriform). One chloroplast and one pyrenoid in each semicell.

1. *Desmidium swartzii* Ag. (Pl. V, Fig. 21). Filaments triangular, twisted. Cell length 18μ, w. 44–46μ, isth. 37–41μ. East Harbor.

LITERATURE CITED

Insam, J. and **W. Krieger.** 1936. Zur Verbreitung der Gattung Cosmarium in Sudtirol. Hedwigia. 76: 95–113.

Irenee-Marie, Frere. 1938. Flora Desmidiale de la Region de Montreal. LaPrairie, Canada.

Joshua W. 1885. On some new and rare Desmidieae. No. III. Jour. Bot. 23: 33–35.

Krieger, W. 1935. The Desmidiaceen. Rabenhorsts Kryptogamen-Flora von Deutschland, Osterreich und der Schweiz. Band 13, Abt. 1. Lief. 2. Seite 225–375.
1937. Ibid. Band 13, Abt. 1. Lief. 4. Seite 537–712.
Messikommer, E. 1935. Die Algenwelt der inneren Plessuralpen. Vierteljahrsschrift der Naturforschenden Gesellshaft in Zürich. 80: 1–59.
Nordstedt, O. and **V. Wittrock.** 1876. Desmidieae et Oedogonieae ab O. Nordstedt in Italia et Tyrolia collectae quas determinaverunt O. Nordstedt et V. Wittrock. Ofversigt af Kongl. Vetenskaps-Akademeins Forhandlinger. No. 6.
Pieters, A. J. 1901. The plants of western Lake Erie, with observations on their distribution. Bull. U. S. Fish Comm. 21 (1902): 57–79.
Prescott, G. W. and **A. Magnotta.** 1935. Notes on Michigan Desmids, with descriptions of some species and varieties new to science. Papers Mich. Acad. Sci., Arts, and Letters. 20: 157–170.
Raciborski, M. 1889. Desmidyje nowe. Pamietnik Wydj. 3 Akad. Umiej. w. Krakawie. 17: 73–113.
Rich, F. 1935. Contributions to our knowledge of the fresh-water of Africa. II. Algae from a Pan in Southern Rhodesia. Trans. Roy. Soc. S. Africa. 23 (2): 107–160.
Schmidle W. 1895. Einige Algen aus Sumatra. Hedwigia 34: 293–307.
Skuja, H. 1928. Vorarbeiten zu einer Algenflora von Lettland IV. Acta Horti Botanici Universitatis Latviensis. 3: 103–218.
Snow, J. W. 1902. The plankton algae of Lake Erie, with special reference to the Chlorophyceae. Bull. U. S. Fish Comm. 22 (1904): 369–394.
Taft, C. E. 1942. Additions to the algae of the west end of Lake Erie. Ohio Jour. Sci. 42 (6): 251–256.
Tiffany, L. H. 1934. The plankton algae of the west end of Lake Erie. Contri. No. 6, The Franz Theodore Stone Lab. The Ohio State Univ. Press, Columbus, Ohio.
1937. The filamentous algae of the west end of Lake Erie. Contri. No. 7, The Franz Theodore Stone Lab. The Amer. Midland Nat. 18 (6): 811–951.
Turner, W. B. 1885. On some new and rare desmids. Jour. Roy. Micro. Soc., Ser. 2, 5 (6): 933–940.
1892. The fresh-water algae of East India. Kongl. Svenska Vetenskaps-Akademiens Handlingar. 25 (2): 1–187.
West, W. G. and **G. S. West.** 1895. A contribution to our knowledge of the fresh-water algae of Madagascar. Trans. Linn. Soc. London, Ser. 2, Botany, 5 (4): 41–90.
1896. On some North American Desmidieae. Trans. Linn. Soc. London, Ser. 2, Botany, 5 (5): 229–274.
1898. On some desmids of the United States. Jour. Linn. Soc. 33 (231): 279–322.
1908. British Desmidiaceae. Vol. 3.
Wolle F. 1884. Desmids of the United States and a list of American Pediastrums. Bethlehem, Pa.

Mainsprings of Civilization

Biological inheritance, cultural endowment and physical environment mould civilizations. None of these can be said to be more important than the others, as all are essential. In his fascinating new book, Mainsprings of Civilization, Professor Huntington impartially discusses the effects of these factors in the determining the course of civilizations. He introduces the term kith to describe a group of people closely knit together by blood and culture. Numerous kiths are discussed and compared in some detail. Special attention is given to the New England Puritans, Jews, Quakers, Junkers, the Parsis of India and the nomads of Arabia. He makes an especially interesting comparison of the Newfoundlanders and Icelanders. The latter have a more advanced culture, in spite of greater handicaps of physical environment. He believes the differences must be due largely to biological inheritance.

Numerous aspects of physical environment are discussed. Weather, diet, religion, climatic cycles, environmental cycles and their bearing on civilization are all given careful consideration. An interesting chapter deals with psychological reactions to weather. Discovery of the use of fire, the invention of windows, the better shelter and clothing have resulted in centers of progress moving from regions where optimum temperatures occur in winter to those where summer temperatures are the most favorable. The nutritive values of the diets of various nations are compared, in which respect Rumania and Russia are far below Italy, and even lower than Japan. Unusual topics, such as animal reproductive cycles and their possible relationship to amount of ozone in the atmosphere are given some attention. Climatic cycles and migrations are treated in some detail.

Mainsprings of Civilization is a comprehensive and entertaining presentation of up-to-date information in this immense field. It represents more than twenty years of research by the author and deserves to be widely read.—*D. C. Rife.*

Mainsprings of Civilization, by Ellsworth Huntington. 660 pp. John Wiley and Sons, Inc., New York. 1945. $4.75.

THE OHIO ACADEMY OF SCIENCE

ANNUAL REPORT OF 1945

REPORT OF THE EXECUTIVE COMMITTEE AND COUNCIL

The one important item handled by the Executive Committee and not reported below as a matter of Council action was the decision to omit the annual meeting for 1945. This decision was due to the restriction placed by the United States Government on meetings of large groups, for the purpose of conserving travel facilities. Since the war in Europe has ended it seems unlikely that another meeting will have to be omitted.

The Council has violated two constitutional provisions by holding only one meeting and by acting without a quorum. No doubt the members of the Academy will recognize that the national emergency made the irregularity unavoidable.

At the meeting in Columbus on April 7, 1945, President Carmen called the group to order and after the roll call a motion by Dr. F. H. Krecker that the sixteen members present act as a quorum was duly passed.

The possibility of providing a seal for use on certificates presented to participants in the Junior Academy was discussed at some length. Dr. Paul Rothemund moved that the Academy furnish certificates and that its official seal embossed over a gold star be used on these certificates.

This discussion led to the consideration of relations with the Junior Academy in general, with a suggestion that outstanding contributors to regional meetings be encouraged to take part in the state meeting and that certificates be awarded to all such participants rather than for the outstanding contributions at the state meeting. Dr. Krecker then proposed as an amendment to the motion that a committee of three be appointed to handle the matter of Junior Academy sponsorship. Dr. Blaydes seconded the amendment and the amended motion was passed.

The Council approved the principle that the Secretary and Treasurer should not leave office in the same year, in the interest of some continuity in the membership of the Executive Committee.

A long discussion of the relations of the Ohio Journal of Science and the Academy, dealing chiefly with payment for the publication of the Proceedings and the address of the Retiring President beyond the normal contribution of the Academy for the support of the Journal brought out a request from Dr. W. L. Evans for the report of the Editorial Board. This report showed that the Journal has felt the pressure of increased cost of publication, partly met by an increase in the contribution from the Ohio State University from $750.00 to $1000.00 per year. The total income from the Academy is uncertain until membership dues are paid, but should be between $900.00 and $1000.00. On motion of Dr. E. I. Yowell, seconded by Dr. Krecker, the Council approved payment for the publication of the two items for 1944. Dr. G. W. White then moved that the Council instruct the Academy Representatives on the Joint Administrative Board to take up the question of specific payment for these items in the future. Dr. Krecker amended to consider the entire question of Academy support of the O. J. S. and the amended motion was passed.

Dr. Krecker moved that all officers for 1944–45 be asked to continue in office for the coming year. The motion was duly seconded and passed unanimously.

The following members were elected to fellowship:

James H. Rodabaugh Francis Lee Utley Clarence Ward

The following new members were elected:

Myron A. Bachtell
John W. Bennett
Arthur H. Blickle
C. E. Cooper
Henry F. Bonner
Edward J. Dury
Albert J. Esselstyn
Lloyd W. Frost
Henry E. Gray
Lysle R. Kirk
J. R. Lockett
James F. Pepper
Newbell Niles Puckett
G. W. Prescott
Charles V. Reichart

Dr. Krecker proposed that a definite deadline be set for applications for grants from the research fund, all applications then to be considered together on a basis of relative merit.

The publication of obituary notices at intervals through the year was suggested in lieu of the usual inclusion of these notices in the annual report.

Dr. C. E. Taft reported on the Research Fund, mentioning a gift from Dr. Herbert Osborn of $100.00, designated for the purchase of a bond, and the Council unanimously voted its thanks to Dr. Osborn.

Respectfully submitted,

A. W. Lindsey, *Secretary.*

REPORT OF THE TREASURER

Columbus, Ohio, July 10, 1945.

To the Ohio Academy of Science:

I submit herewith a financial statement of the condition of the Ohio Academy of Science as of December 31, 1944. The books have been audited and the opinion of the auditor is herewith attached.

Respectfully submitted,

Clarence E. Taft, *Treasurer.*

Ohio Academy of Science Balance Sheet as at December 31, 1944

Assets

Current Expense Fund:		
Cash in Bank		$ 753.39
Interest Receivable		19.50
Bonds Owned:		
Federal Farm Loan 1944–45 (Cost)	$1,300.00	
War Savings Bond, Series F (Cost)	111.00	
Total Bonds Owned		1,411.00
Total Assets—Current Expense Fund		$2,183.89
Research Fund:		
Cash in Bank		$ 353.76
*Banc-Ohio Securities Company Stock (Cost)		437.50
Bonds Owned:		
*Fort Hayes Hotel, Columbus, Ohio (Cost)	$1,300.00	
U. S. War Savings Bond—Series G	100.00	
Total Bonds Owned	1,400.00	
Total Assets—Research Fund		2,191.26
Total Assets		$4,375.15

*See Note, page 208.

Liabilities and Net Worth

Current Expense Fund:		
Liabilities:		
Accounts Payable		$ 210.29
Deferred Credit:		
1945 Dues Collected in 1944		15.00
Total Liabilities and Deferred Credits		$ 225.29
Net Worth:		
Ohio Academy of Science:		
Current Expense Fund Surplus	$1,958.60	
Research Fund Surplus	2,191.26	
Total Net Worth		4,149.86
Total Liabilities and Net Worth		$4,375.15
NOTE: Market values as follows:		
Banc-Ohio Securities Company (25 shares)		$ 500.00
Bonds—Fort Hayes Hotel Company		780.00
Total		$1,280.00

Ohio Academy of Science Statement of Income and Expense
For the Year Ended December 31, 1944

Current Expense Fund

Income:		
Dues—Membership		$1,410.00
Grants for Research		165.00
Sale of Publications		12.56
Interest on Bonds		39.00
Miscellaneous		.10
Total Income		$1,626.66
Operating Expenses:		
Subscriptions—Ohio Journal of Science	$748.50	
Printing:		
Proceedings—Ohio Journal of Science	$195.29	
Other Printing	101.77	
Total Printing	297.06	
Research Grants	165.00	
Postage	24.51	
Office Supplies and Expense	23.85	
Expenses—Officers and Committees, etc.	5.78	
Secretary's Honorarium	100.00	
Auditing Expenses	15.00	
Bond of the Treasurer	5.00	
Safety Deposit Box Rent	3.60	
Bank Charges	2.89	
Total Operating Expenses		1,391.19
Excess of Income over Expenses		$ 235.47

Research Fund

Income:		
Cash Received		$ 243.98
War Savings Bond—Series G		100.00
Total Income		$ 343.98
Expenses:		
Grants for Research		125.00
Excess of Income over Expenses		$ 218.98

AUDITOR'S CERTIFICATE

COLUMBUS, OHIO, July 1, 1945.

To the Ohio Academy of Science:

GENTLEMEN:—In accordance with your instructions, I have audited the accounts and records of the Current Expense Fund of the Treasurer of the Ohio Academy of Science for the year ended December 31, 1944.

I did not audit the Research Fund.

I hereby certify that, in my opinion, the books and records kept on a cash basis are in accord with accepted accounting principles.

In my opinion, the accompanying Balance Sheet and the Statement of Income and Expense for the Current Expense Fund fairly presents the financial condition of the Ohio Academy of Science as at December 31, 1944, and the results of operations for the year ended at that date.

Respectfully submitted,

DANIEL W. SHONTING,
Certified Public Accountant.

REPORT OF THE JOINT ADMINISTRATIVE BOARD OF THE OHIO JOURNAL OF SCIENCE

COLUMBUS, OHIO, December 21, 1944.

To the Ohio Academy of Science:

A special meeting of the Joint Administrative Board of the Ohio Journal of Science was called on December 21, 1944, by the editor at the request of the business manager. The meeting was called to order by Chairman Dr. Snyder. Present were Drs. Snyder and White, representing The Ohio State University, and Drs. Evans and Anderson, representing the Ohio Academy of Science, and Drs. Blaydes and Miller, representing the Ohio Journal of Science.

Dr. Miller presented a partial financial report for Vol. 44, pointing out the fact that the cost of production of the current volume had exceeded the income for the year 1944. The manager requested the board to take the necessary action to avoid a repetition of a similar condition in the coming year.

Dr. White moved that the Ohio State University be requested to increase its contribution from $750.00 to $1000.00. This motion was seconded by Dr. Evans and was passed by a unanimous vote.

Dr. Evans moved that the Ohio Academy of Science be requested to contribute, beyond its normal payment of dues, a sum sufficient to continue the Journal for 1945, but not to exceed the additional amount contributed by the University. The motion was seconded by Dr. Anderson. In the discussion that followed considerable emphasis was placed upon the long history of the Journal and its position among scientific publications. The motion was unanimously adopted.

Dr. Snyder moved that the Editor and Business Manager continue to publish the Journal on the present basis, for the next three issues, pending the outcome of the request to be made of the University and the Academy.

Dr. Blaydes reported on available manuscripts and made a plea for additional papers. Each member of the board was urged to act as a committee of one to aid in securing desirable papers.

There being no further business to come before the board at this time, the meeting was adjourned.

Respectfully submitted,

JOHN A. MILLER,
Secretary of the Board.

COLUMBUS, OHIO, April 5, 1945.

The annual meeting of the Joint Administrative Board of the Ohio Journal of Science was held at Columbus, Ohio, April 5, 1945. The meeting was called to order by Chairman

Snyder. Present were, Drs. Snyder and White, representing the Ohio State University, Dr. Evans, representing the Academy, and Drs. Blaydes and Miller, representing the Journal. Dr. Anderson was unable to attend.

The minutes of the preceding meeting were read and approved.

It was moved, seconded and passed that Drs. Blaydes and Miller be retained as Editor and Business Manager respectively, for the year 1945–46.

Drs. Snyder and White were appointed to audit the accounts of the Journal for the year 1945–46.

Chairman Snyder called for a report from the Editor. Dr. Blaydes' report is herewith attached. The acceptance of the report was moved by Dr. Evans and seconded by Dr. White. The report was unanimously accepted.

The Chairman called for a report from the Business Manager. Dr. Miller's report was in the form of a financial statement for Volume 44 of the Ohio Journal of Science, a copy of which is herewith attached. It was called to the attention of the board that the cost of printing and distributing the Journal for the past year exceeded the income by $338.62.

The greatest single factor incident to the deficit was the decrease in revenue from the Academy. The Academy paid into the treasury of the Journal $1,211.43 in the year 1943 and $748.50 in the year 1944. The total income from all sources to the Journal during 1944 was $282.09 less than received by the Journal during the year 1943.

The simple facts are, the cost of production of the Journal as represented by the six issues of Vol. 44, has exceeded the income for the corresponding period of time. The Journal is not at the present time in debt; this is due to the fact that economies were effected in time to reduce costs to a minimum, and that sufficient operating capital had been accumulated to take care of just such an emergency. That capital has now been reduced to $127.69, an amount insufficient to meet expenses incurred during the first few months of each publication year.

Financial Report of the Ohio Journal of Science

Fiscal Year 1944

Receipts:	
Balance from 1943	$ 466.31
University Allowance	750.00
Ohio Academy of Science—pro rata of Dues	748.50
Subscriptions	97.50
Sale of Back Numbers	38.80
Author's Payment for Plates	169.25
	$2,270.36
Check Outstanding (Mailing Dept., No. 422)	10.85
	$2,281.21
Expenditures:	
Spahr and Glenn Co., Printing Vol. 44, Envelopes and Stationery	$1,760.36
Bucher Engraving Company	302.20
Postmaster	30.00
O. S. U. Mailing Department	15.86
Bank Charges	1.60
Clerical Assistance	41.00
Refund on Foreign Subscription	2.50
	$2,153.52
Balance on hand, March 1, 1945 (Huntington National Bank)	127.69
	$2,281.21

The business manager wishes to call attention to the board and through the board to the Academy the many difficulties which war conditions have precipitated. The Journal must look to the University and to the Academy to bolster its financial structure and insure its continuation. The University has responded by increasing its contribution as requested, from $750.00 to $1,000.00. I now present to the Academy the request as recommended by the board in their December meeting, that this organization assume its full financial obligation

in supporting the continuation of the Journal as the official organ of the society. It is anticipated that the Journal will require a minimum of $1,000.00 from the Academy to insure the publication of Vol. 45.

Dr. White moved the approval of the report of the Business Manager, the motion was seconded by Dr. Evans, and passed by a unanimous vote.

A motion presented by Dr. White, seconded by Dr. Evans and passed by the board is as follows: The board desires to express its appreciation for the faithfulness and efficiency of the Editor and Business Manager in perpetuating a commendable publication under the most trying circumstances.

There being no further business to come before the Board, it was adjourned.

Respectfully submitted,

JOHN A. MILLER,
Secretary of the Board.

REPORT OF THE LIBRARY COMMITTEE

COLUMBUS, OHIO, April 6, 1945.

To the Council of the Ohio Academy of Science:

The sales of publications amounted to $11.60, with nine cents sales tax. No sales were made during the first five months of the year and only ten sales were made during the entire year, five to individuals, three to book dealers and two to libraries.

A few foreign publications have been coming regularly on exchange and several others are now beginning to resume their sendings. Only this week the library received a very large shipment of Swedish publications and also a letter from the New York office of the Swedish government stating that facilities have now been made available for the resumption of shipments of exchange literature and that as soon as practical arrangements can be worked out we will be informed how to send our publications to Sweden. A letter from Chungking asks that we replace the National Central Library on our mailing list as the American postoffice has now resumed parcel delivery to China. It is very probable that similar letters will continue to come. Our part of the exchange can be carried out whenever it is safe to make shipments and whenever the censorship regulations will permit.

Respectfully submitted,

ETHEL MELSHEIMER MILLER, *Chairman.*

REPORT OF THE COMMITTEE ON NECROLOGY

I. ROLLAND DAVID FOX.

Rolland David Fox died suddenly October 24, 1943. At the time of his death, Professor Fox was Associate Professor of Bacteriology at Akron University, a position he had held since 1937. While still an undergraduate, he was made Student Assistant in the Department of Biology at Akron University. His studies were interrupted by World War I in 1918. However, he received his Bachelor of Science degree from the University in 1921. In that year he became a Graduate Assistant in Bacteriology, and in the following year was advanced to the rank of Instructor. In 1923 he was granted the degree of Master of Science, having completed "A Sanitary Survey of Summit Lake and Tributaries." He became Assistant Professor of Bacteriology in 1925, and Associate Professor in 1937, which position he held at the time of his death.

In 1926 he was appointed Director of the Division of Laboratories in the Akron Health Department, which he continued to occupy in conjunction with his position at Akron University. He had also been lecturer in bacteriology at Akron City Hospital since 1923. Holding a commission in the U. S. Army Reserve Corps, he attended army medical school at Carlisle Barracks during 1928 and 1930 and was awarded a certificate by that institution. He was U. S. Army Laboratory Officer, 103 General Hospital, in 1929.

Professor Fox was a member of the Ohio Academy of Science, Society of American

Bacteriologists, A. A. A. S., A. A. U. P., International Association Medical Museums, Ohio Association Sanitarians, American Chemical Society, and the American Commission for the Standardization of Biological Stains (Geneva). He was also district examiner for the American Medical Association.

He was one of the founders of Eta chapter of Phi Sigma at Akron University, and was a member of Phi Delta Theta fraternity, serving later as faculty advisor.

He was born at Peninsula, Ohio, on February 10, 1899. He is survived by his widow and one daughter, Frederica.

II. Eugene Warren Mendenhall.

Eugene Warren Mendenhall died March 24, 1945, at Columbus, Ohio, after an illness of several weeks. He had been associated with the Ohio Department of Agriculture for 37 years, and at the time of his death was State Nursery Inspector.

Mr. Mendenhall was born in Knox County, Ohio, and was graduated by Ohio State University College of Agriculture in 1898. He was a member of the American Association for the Advancement of Science, and the Archaeological and Historical Society of Ohio, Entomological Society of America, as well as the Ohio Academy of Science.

Surviving members of his family are his wife, two daughters, two grandchildren, his brother, and two sisters.

III. John R. Peters.

The very promising geological career of John R. Peters was cut short early in July, 1943, when pneumonia caused his death in a week.

He was a most enthusiastic and capable young investigator, and his death is a sad loss both to friends and to science. He was especially interested in the broader aspects of stratigraphy and sedimentation. Sedimentary petrography, and the geology of the Arizona desert occupied most of his hours.

After a year and a half as a Graduate Assistant and junior colleague at the University of Cincinnati, Mr. Peters went to Earlham College as an Instructor in Geology on a temporary appointment. He became a great favorite of students at Earlham, and showed every indication of making good use of his academic opportunities. At the end of this appointment, he returned to Cincinnati as petrographer at the testing laboratory of the U. S. Army Engineers.

His research material and technical library has been preserved against the war release of one of his close geological friends who evinced an interest in seeing certain aspects of the work brought to publication.

Mr. Peters had received the degree of Bachelor of Science from the University of New Mexico. He had also attended the College of the City of New York, and North Carolina State College.

Respectfully submitted,

Frederick H. Krecker,
Chairman, Committee on Necrology.

THE OHIO ACADEMY OF SCIENCE

CONSTITUTION AND BY-LAWS

(As revised at the Business Session of the Annual Meeting, April 14, 1939, and further Amended at the Annual Meetings of May 9, 1941, April 18, 1942, and April 29, 1943.)

Article I—Name

This organization shall be known as The Ohio Academy of Science.

Article II—Objects

The objects of this Academy shall be the promotion of research in the various departments of science and the diffusion of scientific knowledge.

Article III—Membership

1. *Classes of Members*—The Academy shall be composed of Members, Fellows, Honorary Fellows, Honorary Life Members, and Patrons.

2. *Members*—

a. *Members* shall be persons interested in scientific work. See By-Laws, Chap. I, Secs. 1 and 2.

b. *Life Members*. See By-Laws, Chap. III Sec. 2.

c. *Honorary Life Membership*. This membership is an honor to be conferred upon an active member of long standing who has rendered distinguished service to the Academy. Their number shall not exceed five. See By-Laws, Chap. I, Part 3.

3. *Fellows*—Fellows shall be members who are engaged in productive scientific work. See By-Laws, Chap. II, Secs. 1 and 2.

4. *Honorary Fellows*—Honorary Fellows shall be persons distinguished for their attainments in science, who are not active members of the Ohio Academy of Science, but whose life or work has some basic connection with Ohio. Their number shall not exceed twenty-five. See By-Laws, Chap. II, Secs. 3 and 4.

5. *Patrons*—Patrons shall be persons who have bestowed important favors upon the Academy. See By-Laws, Chap. II, Secs. 5 and 6.

6. *Voters*—Only Members, Fellows, and Patrons resident in Ohio shall be entitled to vote in the Academy. For Sectional Voting Privileges see Art. VIII, Sec. 3.

7. *Officers*—Only Fellows resident in Ohio shall be eligible to office and to membership in the Council of the Academy.

Article IV—Officers, Council and Committees

1. *Officers*—The officers shall be a President, a Vice-President for each Section organized, a Secretary, and a Treasurer.

2. *Council*—

a. The Council shall be composed of the President, Secretary and Treasurer of the Academy, the two most recent Past Presidents, the Chairman of the Trustees of the Research Fund, the Chairman of the Committee on Conservation, the Librarian, the Academy Representatives on the Joint Administrative Board and the Editor and Business Manager of the *Ohio Journal of Science*, the Vice-President and the Membership Committeeman of each organized Section as provided for in Article IV, Section 8d, and Article VI, Section 2b, and at intervals the retiring Secretary.

b. The Council shall have an Executive Committee consisting of the President, Secretary, Treasurer and two Council members elected by the Council.

c. For duties of Council, see Art. V, Sec. 6.

3. *Librarian*—The Academy Librarian shall be one of the members of the Library Staff of the College or University which is the depository for all Academy publications, including the exchanges. He shall be the chairman of the Library Committee. For appointment see Art. V, Sec. 7. For term of office see Art. IV, Sec. 8c.

4. *Historian*—The Academy Historian shall gather and preserve material pertaining to the history of the Academy.

5. *Committees*—

a. *Executive.* For membership see Art. IV, Sec. 2. For duties see Art V, Secs. 2, 5, and 7; and By-Laws, Chap. IV, Sec. 2a.

b. *Membership.* The Membership Committee shall consist of one Fellow from each Section of the Academy, who shall be elected by the Section. See Art. VI, Sec. 2b. For duties see Art. V, Sec. 8. For Chairman see Art. VI, Sec. 2b.

c. *Nominating.* The retiring Vice-Presidents of the various Sections shall constitute the Nominating Committee of the Academy for the Annual Meeting next following their retirement. For duties see Art. V, Sec. 3, and Art. VI, Sec. 1. For Chairman see Art. VI, Sec. 2b.

d. *Program.* The Program Committee shall consist of the Secretary, and the Vice-Presidents of the various Sections. See Art. V, Secs. 3, 4d, and 10.

e. *Library.* The Library Committee shall consist of the Academy Librarian and the two members of the Joint Administrative Board of the Ohio Journal of Science. See Art. V, Sec. 15c.

f. *Publications.* The Publications Committee shall consist of the Secretary of the Academy, who shall be Chairman, and the two Academy Representatives of the Joint Administrative Board of the Ohio Journal of Science. See By-Laws, Chap. V, Secs. 1–5.

g. *Conservation.* The Committee on Conservation shall consist of nine members elected in accordance with the provisions of Art. IV, Sec. 7, and Art. VI, Secs. 1 and 2. For duties see Art. V, Sec. 11.

h. *Necrology.* A Committee on Necrology shall consist of three members elected in accordance with Art. IV, Sec. 8b, and Art. VI, Secs. 1 and 3. For duties see Art. V, Sec. 12.

i. *Resolutions.* The Committee on Resolutions shall consist of three members elected in accordance with Art. IV, Sec. 8, and Art. VI, Secs. 1 and 2. For duties see Art. V, Sec. 13.

6. *Trustees of Research Fund*—Three trustees elected in accordance with Art. IV, Sec. 7, and Art. VI, Secs. 1 and 2, shall be designated Trustees of the Research Fund. For duties see Art. V, Sec. 14.

7. *Joint Administrative Board of the Ohio Journal of Science*—The Academy shall have two representatives on the Joint Administrative Board of the Ohio Journal of Science, elected in accordance with the provisions of Art. IV, Sec. 8c, and Art. VI, Secs. 1 and 2. For duties see Art. V, Sec. 15. See also By-Laws, Chap. V, Sec. 2.

8. *Terms of Office*—The President, Secretary, Treasurer, Trustees of the Research Fund, Members of the Committee on Conservation, Academy Representatives on the Joint Administrative Board, and the Members of the Committees on Necrology and on Resolutions shall be elected by the Academy at the Business Session of the Annual Meeting upon nomination by the Nominating Committee or from the floor of the Meeting in accordance with Art. VI, Secs. 1 and 2.

a. The President, Secretary, and Treasurer shall be elected annually. The President may not succeed himself.

b. The members of the Committee on Necrology and of the Committee on Resolutions, the Trustees of the Research Fund, and the members of the Committee on Conservation shall be elected for a term of three years; one member of the Committee on Necrology, one member of the Committee on Resolutions, one Trustee, and three members of the Committee on Conservation being elected each year.

c. The Academy Representative on the Joint Administrative Board of the Ohio Journal of Science shall be elected for a term of four years, one Representative to be elected biennially. They shall not be members of the Ohio State University.

d. Members of the Membership Committee, one from each Section shall be elected annually by the Sections. The President shall designate the Chairmen of the Membership and Nominating Committees.

e. The term of office of the Academy Librarian and Historian shall be determined by the Council.

f. *Vacancies.* See Art. V, Sec. 7b.

Article V—Duties of Officers, Council and Committees

1. *President*—The President shall discharge the usual duties of a presiding officer at all General Sessions of the Academy and at all meetings of the Council. He shall keep himself constantly informed on the affairs of the Academy and on its acts and those of its officers; and he shall cause the provisions of the Constitution and By-Laws to be faithfully carried into effect. He shall also give an address to the Academy at the Annual Meeting of the year for which he is elected. See also Art. IV, Sec. 8d, and By-Laws, Chap. VII, Sec. 3b.

2. *Absence of President*—The duties of the President in case of his absence or disability shall be assumed by one of the Vice-Presidents designated by the Executive Committee of the Council.

3. *Vice-Presidents*—

a. The Vice-Presidents, elected as provided for in Art. VI, Sec. 2b, shall be Chairmen of their respective Sections.

b. They shall, with the Secretary acting as Chairman, constitute the Program Committee to arrange for the presentation of papers at the Annual Meeting.

c. Each retiring Vice-President shall transmit to the Secretary the names of the incoming Vice-President and Membership Committeeman of his Section.

d. The retiring Vice-Presidents shall constitute the Nominating Committee for the following year, as provided in Art. VI, Sec. 1. For chairman of the Committee see Art. IV, Sec. 8c.

4. *Secretary*—

a. The Secretary shall keep the records of the proceedings of the Academy, the Council and the Executive Committee. He shall maintain a complete list of the Members of the Academy with dates of their election to the different classes of membership and their separation from the Academy.

b. He shall cooperate with the President in attending to the ordinary affairs of the Academy, and shall have charge of the preparation, printing and mailing of circulars, blanks, notifications of election, announcements of meetings, etc.

c. Together with the Academy representatives of the Joint Administrative Board of the Ohio Journal of Science, he shall superintend the publication of the Annual Report and any other printing ordered by the Council or by its executive committee.

d. He shall be the chairman of the Program Committee as constituted in Art. IV, Sec. 5d.

e. After each Annual Meeting the Secretary shall send to each incoming member of the Council a copy of the Constitution; to each incoming Vice-President a list of the voting members of his Section, giving the latest address of each, and indicating which of these members are Fellows.

f. Upon retirement as Secretary, he shall automatically continue to serve as a member of Council for a term of one year.

5. *Treasurer*—The Treasurer shall have the custody of all the funds of the Academy. He may, at his discretion, deposit the funds in a bank (which is a member of the Federal Insurance Deposit Corporation), but he shall not invest them without authority of the Council or of its Executive Committee. He shall keep an account of receipts and disbursements in detail, and these accounts balanced as of the first of January of each year, shall be audited as hereinafter provided. See By-Laws, Chap. IV.

6. *Council*—

a. *Meetings.* The Council shall meet at least twice each year, once on the opening day of the Annual Meeting of the Academy (which shall be known as the Annual Meeting of the Council) and once on a date, set by the Executive Committee, at least sixty days prior to this Annual Meeting. Special meetings of the Council may be called by the President, or by any five members of the Council. See By-Laws, Chap. VII, Secs. 1 and 2.

b. *Duties.* The Council shall be the responsible executive and legislative body of the Academy, and shall have all power in keeping with such responsibility. See Art. IX; and By-Laws, Chaps. I, Sec. 2; II, Secs. 2, 4, and 6; IV, Sec. 2a.

7. *Executive Committee*—See Art. IV, Sec. 2b.

a. The Executive Committee is clothed with the executive authority and legislative powers of the Academy in the intervals between the regular meetings of the Council. No act of the Committee shall, however, remain in force beyond the next meeting of the Council unless ratified by the Council.

b. The Committee shall have the power to fill vacancies ad interim in any of the offices of the Academy.

c. It shall select and nominate to the Council for its action an Academy Librarian whenever necessary.

d. Other duties, see By-Laws, Chap. IV, Secs. 2a and 4.

8. *Membership Committee*—The Membership Committee shall seek to secure new members for the Academy, pass upon the qualifications mentioned in the applications, and make report with recommendations to the Council. As provided in Art. IV, Sec. 2, each Membership Committeeman is also a member of the Council.

9. *Nominating Committee*—See Art. IV, Sec. 5c and Art. VI, Sec. 1.

10. *Program Committee*—The Program Committee shall have charge of the arrangements for the papers and other details of the General and Sectional Sessions of each Annual and Special Meeting of the Academy, these papers and arrangements to be announced in the Official Program immediately before the Meeting. See Art. IV, Sec. 5d.

11. *Committee on Conservation*—The Committee on Conservation shall consider the various possibilities for the conservation of the natural resources of the State and the preservation of the native fauna and flora, including among other effective methods the formation of State Parks in areas of scenic, biologic, or geologic interest; it shall cooperate in all possible ways with other societies, institutions and State officers in the promotion of these objects. See Art. IV, Sec. 5g.

12. *Committee on Necrology*—The Committee on Necrology shall inform itself of any deaths among the members of the Academy, that may occur during the year; and it shall report these deaths to the Academy at the Business Session of the next Annual Meeting. It shall also prepare obituaries of such members for publication in the Annual Report and Proceedings of the Academy. See Art. IV, Sec. 5h.

13. *Committee on Resolutions*—See Art. IV, Sec. 5d. (In view of the suggestions which were made at the meeting of the Council on May 8, 1941, for enlarging the duties of this Committee, the wording of this Section has not yet been formulated.)

14. *Trustees of the Research Fund*—The three Trustees of the Research Fund shall have charge of the allotment and distribution of the income or of the principal of the Research Fund and of any additional gifts for research. See Art. IV, Sec. 6.

15. *Academy Representatives on the Joint Administrative Board of the Ohio Journal of Science*—These representatives shall have the following duties:

a. They are jointly responsible with the two representatives appointed by the President of the Ohio State University for the administration of the affairs of the Journal, and for the appointment annually of the Editor and Business Manager of the Journal. As provided in Art. IV, Sec. 2, they are members of the Council.

b. Together with the Secretary they shall constitute the Publications Committee of the Academy. This committee shall have charge of the preparation and publication of

the Annual Report, Proceedings, Special Papers and such other Academy papers as the Council may consider it desirable to publish. See By-Laws, Chap. V.

c. Together with the Academy Librarian they shall constitute the Library Committee, of which the Librarian shall be the chairman. This Committee shall advise with the Librarians of The Ohio State University on all questions arising in connection with the management of the Library of the Academy, deposited with The Ohio State University Library, and in connection with the distribution of the publications of the Academy.

Article VI—Nomination and Election of Officers

1. *Nominations*—The Nominating Committee shall nominate a candidate for each office to be filled: viz., annually, President, Secretary, Treasurer, one Trustee of the Research Fund, one member each of the Committees on Necrology and Resolutions, three members of the Committee on Conservation, and biennially, i.e., in the odd years, one member of the Joint Administrative Board of the Ohio Journal of Science.

2. *Elections*—

a. The nominations shall be submitted to the Academy at the regular Business Session of the Annual Meeting. See By-Laws, Chap. VII, Sec. 3b.

Election shall be by ballot; a majority vote of the Academy members present shall be necessary for election. For Quorum see Art. VII, Sec. 4.

b. Each regularly organized Section of the Academy shall elect by ballot its representative on the Membership Committee, who shall be a Fellow. This member in the following year shall become the vice-president of his section. The President shall then designate the chairman of the Membership and Nominating Committees. See Art. IV, Sec. 5b.

c. All officers shall enter upon their duties at the adjournment of the Annual Meeting.

Article VII—Academy Meetings

1. *Annual Meeting*—

a. A meeting of the entire Academy will be held each year, which shall be known as the Annual Meeting.

b. Its time and place shall be fixed by the Council subject to such instructions as may be determined by the Academy at the preceding Annual Meeting, and shall be announced by circular at least sixty days before the Meeting.

c. The details of the General and Sectional Sessions shall be arranged by the Program Committee and announced in the Official Program immediately before the Meeting. See By-Laws, Chap. VII, Sec. 3.

2. *Field Meetings*—Field meetings may be arranged by individual Sections or groups of Sections, upon approval by the Council or its Executive Committee.

3. *Special Meetings*—A special meeting of the Academy may be called by the Council or by the Executive Committee upon the written request of twenty Academy members.

4. *Quorum*—Fifty (50) members shall constitute a quorum for the transaction of business.

Article VIII—Sections

1. *Formation of Sections*—Members not less than ten in number may, by special permission of the Council, unite to form a Section for the investigation of any branch of science. Each Section shall bear the name of the science which it represents, e.g., The Section of Geology of The Ohio Academy of Science.

2. *Privileges of Sections*—

a. Each Section is empowered to perfect its own organization as limited by the Constitution and By-Laws of the Academy. It shall report its organization and officers to the Secretary. See Art. VI, Sec. 2b.

b. Each Section shall be represented on the Council by its Vice-President and its representative on the Membership Committee. See Art. IV, Sec. 2.

3. *Sectional Voting Privileges*—Members-elect of the Academy shall indicate on their

nomination blanks the Section in which they wish to have voting privileges. See Art. III, Sec. 6.

4. *Dissolution of Sections*—A Section may be dissolved by the Council at any time that such Section becomes inactive; or for sufficient reason at any other time, with the consent of a majority of the members of the Section.

Article IX—Amendments

Amendments to the Constitution shall be made in the following manner:

a. Initiation of an Amendment shall be by submission to the Secretary in writing of the content of the proposed amendment by 5 or more members of the Academy at least 90 days before the Annual Meeting.
b. Before the Annual Meeting the Secretary shall publish the proposed amendment in the Preliminary Announcement of the Annual Meeting, or in the Official Program, for the information of the members.
c. At least thirty days before the Annual Meeting the Secretary shall send a copy of the proposed amendment to each member of the Council for his ballot.
d. The ballots shall be returned to the Secretary and counted at the Annual Meeting of the Council. A three-fourths vote of the entire Council shall be necessary for approval.
e. The action of the Council shall be presented to the Academy at its succeeding Business Session for its approval. Reversal of the Council's action shall require a majority vote of the Academy members voting.

BY-LAWS

Chapter I—Nomination and Election of Members

1. *Nomination of Members*—Nominations for membership may be made at any time on blanks supplied by the Secretary. Such nominations shall be indorsed by two members who must be acquainted with the nominee and his qualifications for membership.

The Form of Nomination shall be as follows:

The Ohio Academy of Science

....., 19.....

To the Committee on Membership:

I desire to become a Member of The Ohio Academy of Science.

Name.....
Address.....
Major interests.....
Section of the Academy in which Voting Privilege is desired.....
.....
Countersigned by Members:

.....
.....

Annual Dues $2.50.

This form properly filled out and accompanied by dues for one year is to be transmitted to the Secretary who shall turn all nominations over to the Chairman of the Membership Committee. This committee shall pass upon the qualifications mentioned in these applications, and make recommendations thereon to the Council.

2. *Election of Members*—Election shall occur by a majority vote of the Council members present at any regular meeting. Election to membership shall not be considered as completed until dues for the year are paid.

3. *Nomination of Honorary Life Members*—The nomination of Honorary Life Members shall be by the Executive Committee. Such nominations shall be transmitted to the Secretary of the Academy at least thirty days preceding the Annual Meeting and shall be presented to the Council for action at the Annual Meeting of the Academy. A three-fourths majority vote of members of the Council present will be necessary for election. See By-Laws, Chap. III, Part 2b.

Chapter II—Nomination and Election of Fellows, Honorary Fellows and Patrons

1. *Nomination of Fellows*—A suitable blank for the nomination of Fellows shall be supplied by the Secretary and shall be mailed to each Fellow of the Academy at least once each year. The form of nomination shall be as follows:

The Ohio Academy of Science

Nomination for Election to Fellowship

(Must be in the hands of the Secretary at least 30 days before the Council meeting at which the nomination is to be voted on.)

Conditions of Fellowship

1. Fellows shall be members who are engaged in productive scientific work.—*Art. III, Sec. 3, Constitution.*

Date.....

To the Council of the Ohio Academy of Science:

The undersigned Fellows have the honor to nominate

.....

(Give name in full)

for election to Fellowship in the Ohio Academy of Science.

The nominee holds the following degrees: (Give institutions that conferred them).....

.....

is a member of the following scientific societies: (Give length of time a member of each)

.....

.....

and now holds the position of.....

in (Name of Institution).....

located at.....

Respectfully submitted,

(Sgd.)....., Fellow.

(Sgd.)....., Fellow.

The following is a complete list of the important scientific papers published by the nominee, with exact references: (Use other side of this blank if necessary.)

.....

.....

This blank properly filled out, endorsed by two Fellows of the Academy and accompanied by documentary evidence of the nominee's scientific achievements shall be transmitted to the Secretary, who shall present the nomination to the Council for action.

2. *Election of Fellows*—Election shall occur by three-fourths vote of the members of the Council present at any regular meeting.

3. *Nomination of Honorary Fellows*—At least 90 days before the Annual Meeting of the Council, the Secretary of the Academy shall notify the Vice-President of each Section of any vacancies in the ranks of Honorary Fellows, and shall mail to him two forms for the nomination of Honorary Fellows. Each Section through its Vice-President and Fellows may then nominate not more than two candidates. The form of nomination shall be as follows:

The Ohio Academy of Science

Nomination for Election to Honorary Fellowship

(Must be in the hands of the Secretary at least 30 days before the Annual Meeting of Council.)

Conditions of Honorary Fellowship

(1) Honorary Fellows shall be persons distinguished for their attainments in science, who are not active members of the Ohio Academy of Science, but whose life or work has some basic connection with Ohio. Their number shall not exceed twenty-five. (Art. III, Sec. 4, Constitution.)

(2) Honorary Fellows shall be chosen

a. from former members of the Academy for outstanding service in the scientific advancement of the Academy;

b. from other persons who have made important contributions to the development of science in Ohio;

c. from scientists who may have some other special connection with Ohio.

Date.....

To the Council of the Ohio Academy of Science:
The Section of.....of the Ohio Academy of Science has the honor to nominate
.....
(Give name in full)
for election to Honorary Fellowship in the Academy. The nominee holds the following degrees:
(Give institutions that conferred them).....
is a member or former member of the following scientific societies: .....
.....
and now holds the position of.....
in (Name of Institution).....
located at.....

Respectfully submitted,
(Sgd.)....., V. P. of
the Section of.....

a. The nominee is distinguished for the following attainments in Science.....
b. The nominee's special scientific connections with Ohio are.....
.....
c. The following is a list of the more important scientific papers published by the nominee, with exact references: .....
.....
.....
.....

This form properly filled out and accompanied by documentary evidence of the nominee's scientific achievements, and by any other pertinent matter shall be transmitted to the Secretary by the Vice-President at least 30 days before the Annual Meeting of the Council.

As soon as possible thereafter, the Secretary shall send to each member of the Council a list of the nominees together with a brief digest of the reasons for the nominations.

Before the Council Meeting, the Executive Committee shall study the qualifications of the nominee, and shall present recommendations to the Council.

4. *Election of Honorary Fellows*—For election a three-fourths vote of the members of the Council present at the Annual Meeting shall be necessary.

5. *Nomination of Patrons*—The nomination of Patrons shall be by the Executive Committee, and shall be presented to the Council for action. See Art. III, Sec. 5.

6. *Election of Patrons*—Election shall occur by a three-fourths vote of the members of the Council present at its Annual Meeting. The Secretary shall notify the nominee of his election as Patron, and of the privileges accompanying it. See Art. III, Sec. 6.

Chapter III—Dues

1. *Dues*—The annual dues shall be two dollars and fifty cents ($2.50), payable in advance.

2. *Commuted Dues*—

a. A single payment of twenty-five dollars ($25.00) shall excuse a member from all future annual dues and he becomes a Life Member. See By-Laws, Chap. IV, Sec. 2b.
b. Election by the Council to Honorary Life Membership in the Academy shall excuse a member from all future annual dues.

3. *Non-payment of Dues*—

a. Non-payment of annual dues shall deprive a member of the privileges of the Academy and of receiving its publications until such dues are paid.
b. An arrearage continuing over two years shall be construed as notification of withdrawal, which shall become effective after the member concerned has been so informed by the Secretary.

4. *Exemption from Payment of Dues*—

a. Patrons shall be exempt from payment of dues.
b. The Secretary, Treasurer, and Librarian shall be exempt from the payment of dues during the years in which they hold office.

Chapter IV—Finances

1. *Fiscal Year*—The fiscal year of the Academy shall be coincident with the calendar year.

2. *Investments and Expenditures*—

a. *Authorization.* No Academy funds shall be invested or expended, nor shall any debts be incurred without express sanction of the Council or of its Executive Committee, and the signature of the President. It is understood, however, that all ordinary expenses in connection with the Meetings have the permanent sanction of the Academy without special action. See Art. V, Sec. 5, Constitution.

b. *Investment of Commuted Dues.* The sum paid in commutation of annual dues shall be invested, and the interest used for the ordinary purposes of the Academy during the payer's life, but after his death the sum shall be transferred to the Research Fund.

3. *Bills and Vouchers*—Every creditor of the Academy must present to the Treasurer an itemized bill. The Treasurer (if he find the bill properly authorized) shall obtain the certification of the official incurring it, and shall thereupon pay the amount out of any funds not otherwise appropriated; the receipted bill shall be held as his voucher.

4. *Audit*—It shall be the duty of the Executive Committee of the Council to secure an audit of all financial accounts by a competent accountant, who shall report to the Executive Committee before the Annual Meeting.

5. *Bond of Treasurer*—The Treasurer shall give bonds in the sum of five hundred dollars ($500.00) with two good sureties, approved by the Executive Committee, for the performance of his duties and the safe keeping of the funds of the Academy.

6. *Honorarium of Secretary*—The Secretary shall receive an annual honorarium of one hundred dollars ($100.00) from which he shall pay for any clerical help employed by him.

7. *Ohio Journal of Science*—See By-Laws, Chap. V, Sec. 2b.

Chapter V—Publications

1. *Control*—The publications of the Academy shall be in charge of the Publication Committee. See Art. IV, Sec. 5f, Constitution.

2. *Official Organ*—The official organ of the Academy is The Ohio Journal of Science under the following terms of agreement:

1. The Academy shall pay to The Ohio Journal of Science one dollar and fifty cents ($1.50) for each subscription sent to member not in arrears from payment of dues.

b. The Ohio Journal of Science shall publish announcements of meetings, lists of publications for sale, etc., whenever the Academy desires. Such matter, however, may be restricted to one-half page of advertising space in any one issue. See Chap. V, Sec. 3.

c. The Ohio Journal of Science will print papers of from 300 to 1500 words presented at the Annual Meeting, provided such papers are submitted in typewritten form within two weeks from the time of adjournment of the Meeting, and have been passed upon favorably by the Publications Committee and the Editor of the Journal.

3. *Annual Report*—The Annual Report of the Academy including list of Officers, Secretary's report of the Annual Meeting, and such other matter as the Publication Committee may determine, shall be printed as a separate section or issue of the Ohio Journal of Science under the direction of the Publications Committee. The Constitution and By-Laws and a list of members shall be included in the Annual Report at five-year intervals.

4. *Special Papers*—Papers exceeding 1,500 words may be published at the discretion of the Publications Committee as a part of a series of Special Papers.

5. *Proceedings*—The Publications Committee shall at suitable intervals assemble the Annual Reports and the Special Papers into volumes of Proceedings of convenient size, paged consecutively in each volume, under the general title "Proceedings of the Ohio Academy of Science."

6. *Distribution*—

a. One copy of each publication shall be sent free to each Member, Fellow, Honorary Fellow and Patron, except as provided in By-Laws, Chap. III, Sec. 3a, and Chap. V, Sec. 2a.

b. The author of each Special Paper shall receive thirty (30) copies of his memoir.

7. *Publication of President's Address and Other Addresses*—

a. The President's address shall be published in the Ohio Journal of Science as soon as possible after the Annual Meeting, and shall not be published in another scientific magazine until it has appeared in the Journal.

b. Other addresses delivered before the Academy on invitation may be published in the Ohio Journal of Science.

Chapter VI—Research Fund

1. *Sources of Fund*—The Research Fund shall consist of moneys paid by the general public for publications of the Academy, of donations made by Patrons and others in aid of research, and of sums paid in commutation of dues according to By-Laws, Chap. IV, Sec. 2b.

2. *Donors*—Donors to this fund, to the sum of twenty-five dollars ($25.00) or more, shall be entitled without charge to publications subsequently appearing.

3. *Endowment*—The aim of the Academy shall be to accumulate a fund of which the income alone shall be used for the encouragement of research and for the publication of papers bearing upon the development of science in the State.

Chapter VII—Order of Business

1. *Procedure*—All meetings of the Academy and Council shall be governed by "Roberts Rules of Order."

2. *Meetings of the Council*—See Art. V, Sec. 6a, Constitution.

a. *Quorum and Order of Business.* The Council shall arrange its own order of business. A majority of the Council shall constitute a quorum.

b. *Annual Meeting.*

Agenda. The agenda of its Annual Meeting must include the receipt of the reports and recommendations of Standing Committees as follows: Executive Committee, Academy Representatives of the Joint Administrative Board, Program Committee, Trustees of the Research Fund, Committee on Conservation, Membership Committee.

3. *Annual Meeting of the Academy*—See Art. VII, Constitution.

a. *General Session.* The Academy shall have at least one General Session of its membership for the presentation of invited addresses and papers of general scientific interest.

b. *Business Session and Banquet.* There shall be a Business Session and Banquet of the Academy, the order of procedure being as follows:

(a) *Banquet.*

(b) *Welcome, Response and President's Address.*

1. Call to order by the President.
2. Welcome from the Host Institution.
3. Response for the Academy.
4. President's Address.

(c) *Business Session.*

1. Report from the Council.
2. Special Business.
3. Report of Committee on Necrology.
4. Report of Nominating Committee; and Annual Election.
5. Report of Committee on Resolutions.
6. Adjournment.

Chapter VIII—Amendments

These By-Laws may be amended by the same procedure as that stipulated for the amendment of the Constitution. See Art. IX, Constitution.

THE OHIO ACADEMY OF SCIENCE

MEMBERSHIP LIST

ABERNATHY, E. R.—*Psychology*.....State School for the Deaf, Columbus 15
ALDEN, J.—*Eugenics*.....512 Burkhardt Ave., Dayton 3
ALDERMAN, O. A.—*Forestry*.....Experiment Station, Wooster
ALDRICH, J. W. (F. '41)—*Zoology*.....Dept. of Interior, Washington, D. C.
ALEXANDER, L. J.—*Botany*.....343 Blessing Ave., Wooster
ALEXANDER, W. H. (F. '20)—*Meteorology*.....Normandie Hotel, Columbus 15
ALEXOPOULOS, C. J. (F. '41)—*Mycology, Plant Pathology*.....Kent State University, Kent
ALLISON, C. C.—*Plant Pathology and Genetics*.....Ohio State University, Columbus 10
ALTICK, A. R.—*Archaeology*.....Clark County Hist Soc. Museum, Memorial Hall, Springfield
AMSTUTZ, M. E.—*Entomology*.....139 E. Liberty St., Ashland
ANACLETUS, SISTER M.—*Biology*.....St. Mary of the Springs College, Columbus
ANDERSON, A. C. (F. '39)—*Psychology*.....30 Columbia Ave., Athens
ANDERSON, B. G. (F. '41)—*Physiology*.....West Virginia University, Morgantown, W. Va.
ANDRIX, N. W.—*Geology*.....128 E. Royal Forest Blvd., Columbus 2
ANGELITA, SISTER M.—*Botany, Bacteriology, Zoology*,
St. Mary of the Springs College, Columbus
ANGERER, C. A. (F. '42)—*Physiology*.....264 E. Longview Ave., Columbus
ARENSON, S. B.—*Chemistry*.....University of Cincinnati, Cincinnati 21
ATWOOD, H.—*Botany*.....Box 746, Federal Bldg., Columbus
AUSTIN, R. C.—*Medical Science*.....920 Fidelity Bldg., Dayton 2
AVERY, W. F.—*Physics*.....B. F. Goodrich Company, Akron 18

BABY, R. S.—*Physics, Anthropology*.....5705 Brookpark Rd., Cleveland
BACHTELL, M. A.—*Agronomy*.....Experiment Station, Wooster
BACON, F. J. (F. '41)—*Botany*.....Western Reserve University, Cleveland
BALDUF, W. V. (F. '22)—*Zoology*.....308 Harker Hall, Urbana, Illinois
BANGHAM, R. V. (F. '24)—*Anatomy, Entomology*.....1004 N. Beaver St., Wooster
BARBOUR, G. B.—*Geology*.....University of Cincinnati, Cincinnati 21
BARR, D. R.—*Medical Science*.....Box 126, Grand Rapids
BARRETT, R. L.—*Mineralogy*.....Case School of Applied Science, Cleveland
BARROWS, W. M. (F. '20)—*Zoology*.....Ohio State University, Columbus
BARTLEY, F. (F. '44)—*Botany*.....Route No. 4, Circleville
BATTELLE MEMORIAL INSTITUTE—*Metallurgy and Fuels*.....505 King Ave., Columbus
BAUER, A. H.—*Botany*.....Botany Bldg., State College, Pennsylvania
BAUMAN, H.—*Entomology and Animal Ecology*.....1091 Jefferson Ave., Akron
BEAVER, W. C. (F. '30)—*Zoology, Botany, Medical Science*.....Wittenberg College, Springfield
BECK, J. R.—*Geography*.....907 E. Main St., Kent
BENEKE, E. S.—*Botany*.....E. Chestnut St., Oxford
BENNETT, J. W.—*Anthropology*.....Ohio State University, Columbus 10
BERNHAGEN, R. J—*Geology*.....706 Ohio Depts. Bldg., Columbus 15
BERRY, W. (F. '31)—*Geology and Botany*.....Duke University, Durham, N. C.
BEVAN, A. (F. '20)—*Geology*.....Box 1428, University Station, Charlottesville, Va.
BEYER, A. F., Jr.—*Paleobotany*.....2068 Lewis Drive, Lakewood 7
BILLS, A. G. ('43)—*Psychology*.....207 Lafayette Circle, Burnet Woods Station, Cincinnati 20
BINKLEY, L. E.—*Conservation and Ichthyology*.....Wittenberg College, Springfield
BLACKBURN, N. D.—*Entomology*.....Experiment Station, Wooster
BLAKE, F. C. (F. '20)—*Physics*.....Mendenhall Laboratory, O. S. U., Columbus 10
BLAYDES, G. W. (F. '35)—*Botany*.....B. & Z. Bldg., Ohio State University, Columbus 10
BLICKLE, A. H.—*Palaeobotany*.....Box 301, Athens
BODENBERG, E. T. (F. '37)—*Botany, Plant Physiology, Chemistry*,
Dept. of Biology, Wittenberg College, Springfield
BOESEL, M. W. (F. '41)—*Entomology, Zoology*.....R. R. No. 2, Oxford
BOETTICHER, A. W.—*Biology, Botany*.....Ohio University, Athens
BOGNAR, E. J.—*Geology*.....507 Oliver Bldg., Pittsburgh, Pa.
BOLE, B. P., Jr. (F. '41)—*Ornithology, Mammology*.....2717 Euclid Ave., Cleveland
BOND, R. H.—*Geology*.....Capital University, Columbus 9
BOORD, C. E. (F. '39)—*Chemistry*.....Ohio State University, Columbus 10
BORROR, D. J. (F. '36)—*Entomology, Ecology, Taxonomy of Odonata*,
1593 Minnesota Ave., Columbus 3

BOSSERT, R. B.—*Bacteriology*.....Ohio Wesleyan University, Delaware
BOWMAN, H. H. M. (F. '21)—*Botany, Zoology*.....Toledo University, Toledo
BOYD, M. J.—*Biochemistry*.....2518 Cornell Place, Cincinnati 20
BRAND, LOUIS (F. '39)—*Mathematical Physics*.....University of Cincinnati, Cincinnati 21
BRANT, A. M. (F. '41)—*Mineralogy, Chemistry*, Lord Hall, Ohio State University, Columbus 10
BRAUN, A. F. (F. '22)—*Zoology*.....R. R. 13, Box 41c, Cincinnati
BRAUN, E. L. (F. '21)—*Botany*.....R. R. 13, Box 41c, Cincinnati
BRIDGHAM, C. M.—*Biochemistry*.....R. F. D. No. 1, North Jackson
BRIEF, B. J.—*Medical Science*.....769 Kimball Place, Columbus
BRILL, H. C. (F. '40)—*Chemistry*.....Miami University, Oxford
BROMLEY, MRS. S. W. (F. '31)—*Botany*.....Scofieldtown Rd., Stamford, Conn.
BROWER, A. B.—*Medical Science*.....60 Wyoming St., Dayton 9
BROWN, D. M.—*Taxonomy*.....3310 Eleventh St. S. W., Canton 4
BROWN, H. D.—*Horticulture*.....Ohio State University, Columbus 10
BROWN, H. P.—*Entomology*.....Ohio State University, Columbus 10
BROWN, J. B. (F. '39)—*Chemistry*.....1190 Lincoln Rd., Columbus
BRYANT, E. R.—*Biology*.....117 Lakeside, New Concord
BUCHANAN, F.—*Ornithology*.....Amsterdam
BUCHANAN, K.—*Aeronautics*.....Box 148, Amsterdam
BUCHER, W. H. (F. '20)—*Geology, Physics*.....Columbia University, New York City
BUGELSKI, R., *Psychology*.....University of Toledo, Toledo
BULGER, J. W.—*Entomology, Plant Pathology, Zoology*...127 U. S. Court House, El Paso, Texas
BURGESS, W. M. (F. '42)—*Chemistry*.....University of Cincinnati, Cincinnati
BURNS, G. W.—*Plant Science*.....2466 Wahl Terrace, Cincinnati 11
BURRELL, R. C. (F. '41)—*Agricultural Chemistry*.....Ohio State University, Columbus 10
BURTT, H. E. (F. '21)—*Psychology*.....Ohio State University, Columbus 10
BUSCH, K. G. A. (F. '36)—*Chemistry, Geology*.....Capital University, Columbus 9

CARLSON, F. A. (F. '38)—*Geography*.....171 Oakland Park Ave., Columbus
CARMAN, J. E. (F. '20)—*Geology*.....Ohio State University, Columbus 10
CASTER, K. E. (F. '43)—*Paleontology*.....University of Cincinnati, Cincinnati 21
CECIL, RODNEY—*Entomology*.....P. O. Box 1330, Ventura, Calif.
CHADWICK, L. C.—*Horticulture*.....Ohio State University, Columbus 10
CHANDLER, D. C. (F. '41)—*Limnology, Fisheries, Biology*.....Stone Laboratory, Put-in-Bay
CHAPMAN, F. B.—*Natural Science*.....1944 Denune Ave., Columbus 3
CHASE, S. W. (F. '24)—*Zoology*.....2109 Adelbert Rd., Cleveland
CHILDERS, N. F. (F. '41)—*Plant Physiology, Horticulture, Chemistry*,
Ohio State University, Columbus 10
CHURCH, M. B.—*Mycology*.....Lyndon, Vermont
CINCINNATI UNIVERSITY GENERAL LIBRARY.....Cincinnati 21
CLAPP, P. S.—*Physics*.....107 Ashbourne Rd., Columbus
CLARK, C. F.—*Mollusca, Fish, Aquatic Regulation*.....St. Marys
CLEVELAND MUSEUM OF NATURAL HISTORY.....2717 Euclid Ave., Cleveland
COLE, L. E. (F. '43)—*Psychology*.....111 S. Cedar, Oberlin
COLE, W. S. (F. '36)—*Geology*.....Ohio State University, Columbus 10
CONREY, G. W. (F. '24)—*Geology*.....Ohio State University, Columbus 10
COOPER, C. E.—*Geography*.....Box 385, Athens
COSSABOOM, R. T.—*Entomology*.....Baldwin-Wallace College, Berea
COSTELLO, R. E.—*Biology*.....912 Latty St., Defiance
COTTERMAN, C. W.—*Genetics, Statistics*.....University of Michigan, Ann Arbor, Mich.
COTTINGHAM, K. C. (F. '29)—*Geology*.....103 Riverview Park Drive, Columbus
COYLE, E. E. (F. '40)—*Botany, Zoology*.....College of Wooster, Wooster
CRIST, E. L.—*Botany*.....I. O. O. F. Bldg., Circleville
CRITTENDEN, H. W.—*Botany*,
Diet Medical Dept., Walseman Gen. Hospital, Camp Atterbury, Ind.
CROSS, A. T.—*Botany, Geology*.....4800 Forbes St., Pittsburgh, Pa.
CROWELL, S.—*Zoology*.....Miami University, Oxford
CUNNINGHAM, H. A.—*Biology, Science Education*.....227 N. Depeyster St., Kent
CUNNINGHAM, J. F.—*Zoology, Entomology, Botany*.....Ohio State University, Columbus 10
CURTIS, G. M. (F. '39)—*Medical Sciences, Biology*.....Ohio State University, Columbus 10
CUTRIGHT, C. R. (F. '30)—*Entomology*.....Experiment Station, Wooster

DAMBACH, C. A.—*Plant and Animal Ecology, Ent., Conservation*,
Ohio State University, Columbus 10
DARKER, G. D.—*Mycology*.....19402 Maple Hts. Blvd., Maple Heights, Bedford P. O.
DAVIDSON, R. H. (F. '36)—*Entomology*.....Ohio State University, Columbus 10
DAVIS, A.—*Physical and Biological Science*.....Box 424, Columbus
DEAM, C. C. (F. '30)—*Botany, Forestry*.....Bluffton, Indiana

DEAROLF, K.—*Cave Fauna of U. S.*.....Public Library Museum, Dayton
DEICHMANN, W.—*Toxicology, Physiology, Pharmacology*.....527 McAlpin, Cincinnati 20
DELONG, D. M. (F. '21)—*Zoology, Entomology*.....Ohio State University, Columbus 10
DELOR, C. J.—*Medical Science*.....2074 Arlington Ave., Columbus
DETWEILER, F. G. (F. '42)—*Sociology*.....Denison University, Granville
DEXTER, R. W. (F. '43)—*Biology, Ecology*.....Kent State University, Kent
DICKERMAN, E. E.—*Zoology*.....Bowling Green State University, Bowling Green
DICKERSON, L. M.—*General Biology, Genetics, Parasitology, Chemistry*,
Soil Conservation Service, Spartanburg, S. C.
DIETZ, DAVID (F. '33)—*Astronomy, Physics*.....2891 Winthrop Road, Shaker Heights
DIETZ, H. F. (F. '32)—*Entomology*.....2805 Monroe St., Wilmington, Del.
DILLER, O. D. (F. '40)—*Botany*.....Experiment Station, Wooster
DOAN, C. A. (F. '39)—*Medicine and Biological Sciences*.....Ohio State University, Columbus 10
DOAN, K. H.—*Ecology, Fish*.....Central Biological Laboratory, Winnipeg, Manitoba
DOBBINS, R. A. (F. '38)—*Botany and Entomology*.....Ohio Northern University, Ada
DOCKERAY, F. C. (F. '24)—*Psychology*.....Ohio State University, Columbus 10
DODD, D. R.—*Botany, Geology, Soils*.....Ohio State University, Columbus 10
DONNER, H. F.—*Geology*.....Western Reserve University, Cleveland
DOW, C. L.—*Geography, Geology, Meteorology*.....45 Maplewood Drive, Athens
DRAKE, C. J. (F. '21)—*Entomology*.....Iowa State College, Ames, Iowa
DREYER, J. F.—*Chemistry*.....3314 Losanteridge Ave., Cincinnati 13
DREYER, W. A.—*Zoology*.....University of Cincinnati, Cincinnati 21
DRILL, E.—*General Biological Science*.....202 S. Campus, Oxford
DUNKLE, D. H.—*Vert. Pal.*.....2717 Euclid Ave., Cleveland 15
DUNLAP, H. L.—*Chemistry*.....275 E. State St., Athens
DURY, E. J.—*Zoology*.....University of Dayton, Dayton

EBAUGH, W. C. (F. '40)—*Chemistry*.....Denison University, Granville
EDELMANN, A.—*Medical Sciences*.....1588 Northwest Blvd., Columbus 8
EDGERTON, H. A. (F. '42)—*Psychology*.....Natatorium, Ohio State University, Columbus 10
EDWARDS, L. F. (F. '32)—*Zoology*.....Ohio State University, Columbus 10
EDWARDS, R. L. (F. '32)—*Physics, Mathematics*.....Miami University, Oxford
EGGLESTON, H. R. (F. '41)—*Zoology*.....Marietta College, Marietta
EHLERS, G. M. (F. '40)—*Geology, Palaeontology, Zoology*,
Museum of Paleontology, University of Michigan, Ann Arbor, Mich.
EISEN, E. E.—*Geography*.....126 Wilson Ave., Kent
ELLIOTT, R. (F. '33)—*Zoology, Medical Science*.....Ohio University, Athens
EMO, L.—*Physics*.....1601 Perry St., Columbus
ENGLE, O. H.—*Zoology, Botany*.....1409 Robinwood Rd., Alliance
ENGLISH, H. B. (F. '30)—*Psychology*.....Ohio State University, Columbus 10
ERF, H. A.—*Physics*.....17355 S. Woodland, Shaker Heights
ESSELSTYN, A. J.—*Chemistry*.....110 N. Vine St., Westerville
EVANS, M. W. (F. '41)—*Agronomy*.....Experiment Station, Wooster
EVANS, W. L. (F. '21)—*Chemistry*.....Ohio State University, Columbus 10
EVERHART, W. A.—*Chemistry*.....Denison University, Granville
EVERLY, R. T.—*Entomology, Botany*.....Purdue Agr. Exp. Station, W. Lafayette, Ind.
EY, L. F.—*Bacteriology*.....672 City Park, Columbus

FATTIG, P. W.—*Zoology*.....Emory University, Atlanta, Ga.
FEDERIGHI, H.—*Biology*.....Antioch College, Yellow Springs
FENNEMAN, N. M. (F. '20)—*Geology, Geography*.....University of Cincinnati, Cincinnati 21
FIELDS, P. E. (F. '40)—*Psychology*.....138 N. Sandusky St., Delaware
FINK, O. E.—*Conservation*.....3050 Indianola Ave., Columbus
FISCHER, M. H. (F. '20)—*Exper. Medicine*.....College of Medicine, Eden Ave., Cincinnati 19
FLOWER, R. H. (F. '42)—*Geology, Paleon.*.....New York State Museum, Albany, N. Y.
FORBES, W. C.—*Biology, Chemistry*.....King's College, Newcastle, Del.
FORD, E. W.—*Physics*.....Station No. 2, Wooster
FOREMAN, F. (F. '35)—*Geology*.....217 Woodland Ave., Oberlin
FRANKS, R. W. (F. '41)—*Ornithology, Botany*.....State Office Bldg., Columbus 15
FRIESNER, R. C. (F. '34)—*Botany*.....Butler University, Indianapolis, Ind.
FRONIUS, A. G.—*Chemistry*.....785 New Garden Ave., Salem
FROST, L. W.—*Geology*.....3582 Olentangy Blvd., Columbus
FROST, R. B. (F. '35)—*Geology, Geography*.....21 N. Cedar St., Oberlin
FRYE, W.—*Geology*.....Central High School, Akron 8
FULFORD, M. (F. '34)—*Botany, Geology*.....University of Cincinnati, Cincinnati 21
FULLER, J. O.—*Geology*.....West Virginia University, Morgantown, W. Va.
FULLMER, E. L. (F. '20)—*Biology*.....Baldwin-Wallace College, Berea

GARBER, H. J. (F. '42)—*Chemistry*.....Cincinnati University, Cincinnati 21
GARRETT, A. B. (F. '40)—*Chemistry*.....205 W. Henderson Rd., Columbus
GEIGER, W. O.—*Biology, Chemistry*.....134 Washington, Bluffton
GEISLER, J. G.—*Chemistry*.....University of Dayton, Dayton
GEIST, R. M. (F. '32)—*Entomology, Ornithology*.....Capital University, Columbus 9
GENTRY, J. R.—*Psychology*.....163 N. Congress St., Athens
GERBERICH, J. B.—*Zoology*.....Ohio State University, Columbus 10
GIBBONS, C. C.—*Psychology*.....Personnel Division, Owens-Illinois Glass Co., Toledo 1
GIEBNER, B. M.—*Plant Science*.....Alfred U. Extension, Jamestown, N. Y.
GIER, H. T.—*Herpet., Ornith., Mammal*.....Ohio University, Athens
GILLESPIE, J. S.—*Geology*.....1075 Madison Ave., Columbus
GLATHART, J. L.—*Physics*.....Gambier
GLENNY, F. H.—*Botany*.....1148 Linden Ave., Akron
GOOD, E. E.—*Botany, Zoology*.....Route 5, Van Wert
GOSLIN, C. R.—*Botany*.....726 E. King St., Lancaster
GOSLIN, R. M.—*Archeology*.....316 Wilson Ave., Columbus
GOSLIN, W. E.—*Botany*.....316 Wilson Ave., Columbus
GOSS, G. I.—*Geology, Geography*.....1311 23rd St. N. W., Canton 3
GOURLEY, J. H. (F. '26)—*Horticulture*.....Ohio State University, Columbus 10
GOWDY, R. C. (F. '20)—*Physics*.....2111 Auburn Ave., Cincinnati 19
GRAY, H. H.—*Geology*.....Box 272, New Philadelphia
GRAY, J. C.—*Experimental Medicine*.....Western Reserve University, Cleveland
GREEN, W.—*Anthropology*.....13914 Emery Ave., Cleveland
GROVER, F. O. (F. '20)—*Botany*.....180 Morgan St., Oberlin

HAHNERT, W. F. (F. '41)—*Zoology*.....Ohio Wesleyan University, Delaware
HALE, K.—*Biology*.....626 W. Main St., Wilmington
HALE, POLYANNA—*Plant Science*.....Ohio State University, Columbus 10
HALL, A. A. (F. '41)—*Medical Science*.....833 Middlesex, Gloucester, N. J.
HAMILTON, F. E.—*Medical Science*.....Ohio State University, Columbus 10
HANAWALT, F. A.—*Zoology*.....65 W. Broadway, Westerville
HARPER, A. R. (F. '41)—*Botany, Zoology*.....559 Arden Road, Columbus
HARRIS, J. S.—*Anthropology*.....Ohio State University, Columbus 10
HARRIS, M. R.—*Plant Pathology, Forestry*.....Maine Agr. Exp. Station, Orono, Maine
HARTMAN, F. A. (F. '40)—*Medical Science*.....Ohio State University, Columbus 10
HARTSON, L. D. (F. '32)—*Psychology*.....Oberlin
HAUB, J. G.—*Zoology*.....Ohio State University, Columbus 10
HAYHURST, E. R. (F. '21)—*Medical Science*.....1925 Concord Road, Columbus 8
HAZARD, F. O. (F. '41)—*Biology*.....140 Fifth Ave., Wilmington
HEFNER, R. A. (F. '32)—*Zoology*.....E. Chestnut St., Oxford
HEINLE, A. R.—*Botany*.....1001 Culbertson Ave., Zanesville
HENDERSON, W. E. (F. '21)—*Chemistry*.....214 Sixteenth Ave., Columbus 1
HENDRICKSON, G. (F. '43)—*Psychology*.....University of Cincinnati, Cincinnati 21
HERNDON, L. K.—*Chemistry, Engineering*.....2303 Onandaga Drive, Columbus 8
HERRICK, J. A. (F. '40)—*Biology*.....University of Michigan, Ann Arbor, Mich.
HERSH, A. H. (F. '35)—*Embryology, Genetics*.....Western Reserve University, Cleveland
HIBBARD, H. (F. '31)—*Zoology*.....Oberlin College, Oberlin
HICKS, L. E. (F. '34)—*Botany, Ornithology*.....Ohio State University, Columbus 10
HILLS, N. E.—*Archeology*.....Kelley's Island
HITCHCOCK, F. A. (F. '28)—*Zoology, Physiology*.....Ohio State University, Columbus 10
HODGMAN, C. D. (F. '40)—*Physics*.....Case School of Applied Science, Cleveland
HOERR, N. L. (F. '42)—*Anatomy*.....2109 Adelbert Rd., Cleveland 6
HOLLENBECK, Z. J. R.—*Gyn. and Obs*.....9 Buttles Ave., Columbus
HOLLINGSWORTH, M.—*Chemistry*.....Ohio State University, Columbus 10
HOLT, R. D.—*Strat. and Sed*.....U.S.G.S., Box 272, New Philadelphia
HOSKINS, J. H. (F. '27)—*Palaeobot*.....University of Cincinnati, Cincinnati 21
HOUSEHOLDER, F. F.—*Physics*.....1209 Berwin St., Akron
HOUSER, J. S. (F. '21)—*Entomology*.....Experiment Station, Wooster
HOWARD, N. F. (F. '32)—*Entomology*.....151 W. Eleventh Ave., Columbus 1
HOWARD, W. H.—*Zoology, Entomology*.....238 Douglas St., Wilmington
HOWLETT, F. S. (F. '41)—*Botany, Horticulture*.....Experiment Station, Wooster
HUBBARD, G. D. (F. '20)—*Physiog*.....279 Oak St., Oberlin
HUBER, H. E. (F. '40)—*Biology*.....Ohio Northern University, Ada
HUDSON, N. P. (F. '39)—*Bacteriology*.....Ohio State University, Columbus 10
HUGHES, J. H.—*Entomology*.....U. S. Pub. Health Service, Quarantine Sta., New Orleans, La.
HUMPHREY, S. S.—*Plant Pathology*.....Ohio State University, Columbus 10
HUNTINGTON, C. C. (F. '37)—*Geography*.....Ohio State University, Columbus 10
HYDER, A. E.—*Botany*.....Ohio State University, Columbus 10

IRWIN, N. M.—*Botany*.....5017 Anderson Place, Cincinnati 27

JACOBS, E. E. (F. '36)—*Botany, Geology*.....Ashland College, Ashland
JARVIS, C. W. (F. '41)—*Physics*.....158 E. Northwood Ave., Columbus
JENNINGS, O. E. (F. '20)—*Botany*.....Carnegie Museum, Pittsburgh 13, Pa.
JOHNSON, E. H. (F. '28)—*Physics*.....Gambier
JOHNSON, F.—*Plant Pathology*.....Western Washington Exp. Sta., Puyallup, Wash.
JOHNSON, H. W. (F. '40)—*Botany*,
Div. Forest Crops and Diseases, Bureau of Plant Industry Station, Beltsville, Md.
JOHNSTON, L.—*Archaeology*.....807 Toledo Trust Bldg., Toledo 4
JOLY, R. A.—*Botany*.....University of Dayton, Dayton
JONES, C. H. (F. '41)—*Botany*.....Ohio State University, Columbus 10
JONES, D. T.—*Mollusca*.....University of Utah, Salt Lake City, Utah
JONES, E. P.—*Zoology, Protozoology, Genetics, Physiology*.....University of Akron, Akron
JONES, F. L.—*Botany, Geology*.....1037 E. McMillan St., Cincinnati 6
JONES, G. T. (F. '41)—*Ecology*.....322 W. College St., Oberlin
JONES, L. (F. '20)—*Ornithology*.....352 W. College St., Oberlin
JOSEPH, SISTER M.—*Biology*.....Notre Dame College, South Euclid
JOTTER, E. V.—*Botany*.....Box 51, Cambridge

KAVANAGH, R.—*Zoology*.....574 Arden Rd., Columbus
KEHOE, R. A. (F. '33)—*Physiology*.....College of Medicine, Eden Ave., Cincinnati 19
KELLEY, K. L.—*Zoology*.....Kent State University, Kent
KEMPER, R. L.—*Chemistry*.....3950 Regent Ave., Norwood
KENDEIGH, S. C. (F. '35)—*Biology, Ornithology*.....Vivarian Bldg., Champaign, Ill.
KENNEDY, C. H. (F. '22)—*Entomology*.....Ohio State University, Columbus 10
KERSTEN, H. J. (F. '39)—*Physics and Mathematics*.....University of Cincinnati, Cincinnati 21
KETTERING, C. F. (F. '40)—*Research, automotive design and production, elect., physical, aeronautical and mechanical*.....807 Winters Bank Bldg., Dayton 2
KING, D. D.—*Public Health*.....81 N. Warren Ave., Columbus
KING, J. D.—*Medicine*.....Ohio State University, Columbus 10
KIRK, L. R.—*Geology*.....843 Timberman Rd., Columbus 8
KITCHIN, P. C. (F. '39)—*Medical Science*.....Ohio State University, Columbus 10
KNAUSS, H. P. (F. '40)—*Physics*.....42 Richardson St., Belmont 78, Mass.
KNOUFF, R. A. (F. '32)—*Medical Science*.....Ohio State University, Columbus 10
KNOX, GEORGE—*Psychology*....U. S. Naval Personnel Bureau, Navy Dept., Washington, D. C.
KNULL, J. N. (F. '36)—*Zoology*.....Ohio State University, Columbus 10
KOCH, W. R.—*Physics and Chemistry*.....560 E. Monteray, Dayton 9
KOSTIR, W. J. (F. '20)—*Zoology*.....Ohio State University, Columbus 10
KRAATZ, W. C. (F. '23)—*Entomology*.....University of Akron, Akron 4
KRECKER, F. H. (F. '20)—*Biology*.....Ohio University, Athens
KUEHNLE, C. H.—*Botany, Ecology*.....2332 Tenth St. N. W., Canton 3

LAMB, G. F. (F. '20)—*Geology*.....233 Hartshorn St., Alliance
LAMBORN, H. M. (F. '20)—*Geology*.....224 Piedmont Rd., Columbus
LAMBORN, R. C. (F. '29)—*Geology*.....Ohio State University, Columbus 10
LAMEY, C. A. (F. '39)—*Geology*.....Ohio State University, Columbus 10
LAMPE, L. (F. '31)—*Botany*.....Ohio State University, Columbus 10
LANDE, A. (F. '40)—*Physics*.....Ohio State University, Columbus 10
LANDIS, B. J. (F. '37)—*Entomology*.....P. O. Box 218, Union Gap, Wash.
LANGLOIS, T. H. (F. '37)—*Ichthyology*.....P. O. Box C, Put-in-Bay
LAPAZ, L.—*Math., Geol., Meteor*.....University of New Mexico, Albuquerque, N. M.
LAURIE, A.—*Horticulture*.....Ohio State University, Columbus 10
LAWRENCE, W. E. (F. '42)—*Sociology*.....2272 Bellfield Rd., Cleveland
LEEDY, D. L.—*Ornithology*.....Ohio State University, Columbus 10
LEWIS, C. H.....Harpster
LEWIS, R. D. (F. '40)—*Plant Gen., Ecol., Physiol*.....Ohio State University, Columbus 10
LIBAL, F. J.—*Geography*.....2608 Natchez Ave., Cleveland 9
LICHT, W., JR.—*Chemistry*.....University of Cincinnati, Cincinnati 21
LINDSEY, A. W. (F. '27)—*Entomology*.....Denison University, Granville
LINK, J. A.—*Medical Science*.....14 N. Limestone St., Springfield
LINSCHEID, A. G.....1901 Templehurst Dr., Cleveland 21
LIPKIND, W.—*Anthropology*.....Ohio State University, Columbus 10
LOCKETT, J. R.—*Geology*.....378 Sherbourne Dr., Columbus
LOGAN, M. A. (F. '41)—*Biochemistry*.....Medical College, Cincinnati 19
LONG, W. L.—*Apparatus and Supplies*.....1700 Irving Park Blvd., Chicago, Ill.
LUDLAM, E. L.—*Chemistry*.....Western College, Oxford

LUTZ, A. L.—*Physics*.....Wittenberg College, Springfield
LYMAN, J. F.—*Chemistry*.....Townshend Hall, O. S. U., Columbus 10

MACDONELL, J. A.—*Geology*.....922 National Bank Bldg., Lima
MACHLE, W. (F. '41)—*Physiology*.....Armored Force Medical Lab., Fort Knox, Ky.
MACKNIGHT, F. C.—*Geology, Geography*.....2780 East Blvd., Cleveland
MACNEILLE, H. M.—*Mathematics*.....Kenyon College, Gambier
MACQUIGG, R. E.—*Medicine*,
Box 358, Presbyterian Hospital, 622 W. 168th St., New York 32, N. Y.
MADDOX, J. T.—*Geography, Physiog*.....22631 Seabrooke Ave., Euclid 17
MAGLY, J. W.—*Chemistry*.....2731 Vine St., Cincinnati 19
MAHARRY, J. F.—*Geography, Geology, Meteorology*.....159 W. High St., New Concord
MAHR, A. C. (F. '42)—*Anthropology*.....2079 W. Fifth Ave., Columbus
MANCHESTER, R. E. (F. '42)—*Mathematics*.....Kent State University, Kent
MANSON, E. S., JR.—*Astronomy, Physics, Mathematics*.....Ohio State University, Columbus 10
MANUEL, W. A. (F. '36)—*Chemistry*.....Ohio Wesleyan University, Delaware
MARK, C. G. (F. '20)—*Geology, Botany*.....270 S. State St., Westerville
MARTIN, C. G.—*Chemistry, Physics*.....Bowling Green State University, Bowling Green
MASON, H. C. (F. '37)—*Zoology*.....151 W. Eleventh Ave., Columbus 1
MASTERS, C. O.—*Aquatic Biology*.....4357 Gennings Rd., Cleveland 9
MATEER, F. (F. '21)—*Psychology*.....31 Monroe Ave., Columbus
MATHER, K. F. (F. '22)—*Geology*....Geological Museum, Harvard Univ., Cambridge 38, Mass.
MATHEWS, C. O. (F. '32)—*Education, Personnel*.....57 N. Washington St., Delaware
MAXFIELD, F. N. (F. '32)—*Psychology*.....Ohio State University, Columbus 10
MAYFIELD, S. M.—*Geology, Geography*.....Bowling Green State University, Bowling Green
MCAVOY, B.—*Biology*.....108 W. Ash St., Normal, Ill.
MCCAUGHEY, W. J. (F. '29)—*Geology, Chemistry*.....Ohio State University, Columbus 10
MCCLEERY, J. M.—*Medical Science*.....Muskingum College, New Concord
MCCLURE, F. A. (F. '37)—*Botany*.....315 Willard Ave., Chevy Chase, Md.
MCCLURE, O. E.—*Physics, Mathematics, Chemistry*.....Box 548, Athens
MCCORMICK, R. N.—*Zoology*.....508 S. Tolley Ave., Muncie, Ind.
MCCULLOUGH, A. S.—*Petroleum Geology*.....Clifton, Greene Co.
MCEWEN, R. S. (F. '30)—*Zoology*.....Oberlin College, Oberlin
MCGREW, J. B.—*Phys. Sci., Chem., Biol., Astro*.....708 First National Bank Bldg., Springfield
MCNELLY, W. C. (F. '28)—*Zoology*.....115 S. Beech St., Oxford
MCPHERSON, W. (F. '20)—*Chemistry*.....198 Sixteenth Ave., Columbus
MEAD, F. W., *Entomology*.....227 W. Brighton, Columbus
MERRELS, C. W., *Geology*.....c/o U. S. G. S., Box 272, New Philadelphia
METCALF, Z. P. (F. '32), *Ornithology*.....State College Sta., Box 5215, Raleigh, N. C.
MEYER, B. S. (F. '30), *Botany*.....Ohio State University, Columbus 10
MEYER, J. H., *Medicine*.....c/o Charles Cohen, 2018 Belle Ave., Lakewood
MICHAEL, L. J., *Chemistry*.....Otterbein College, Westerville
MIGLARESE, J., *Organic Chemistry*.....1940 Cordova Ave., Cincinnati 24
MILLER, D. F. (F. '30), *Zoology*.....Ohio State University, Columbus 10
MILLER, E. M., *Librarian*.....Ohio State University, Columbus 10
MILLER, E. J., *Geology, Geography*.....Loudonville Times, Loudonville
MILLER, E. W., *Geography, Geology*.....Western Reserve University, Cleveland
MILLER, F. D., *Astronomy*.....Granville
MILLER, F. N., *Chemistry*.....Xavier University, Evanston Sta., Cincinnati 7
MILLER, G. R., *Botany*.....R. R. No. 1 A, Green Springs
MILLER, J. A. (F. '36), *Zoology*.....Ohio State University, Columbus 10
MILLER, J. N. (F. '43), *Zoology*.....Ohio State University, Columbus 10
MILLER, W. C. (F. '40), *Zoology*.....125 E. Ellenwood Ave., Bedford
MITCHELL, R. H., *Geology, Chemistry*.....19 S. Liberty St., New Concord
MOGENDORFF, N. (F. '36), *Plant Pathology*.....University of Toledo, Toledo 6
MOKE, C. B., *Geology*.....College of Wooster, Wooster
MOLZ, F. J. (F. '41), *Biology*.....University of Dayton, Dayton 9
MOON, M. (F. '40), *Botany, Zoology*.....221 Spring St., Bluffton
MOORE, D. M. (F. '40), *Botany*.....University of Arkansas, Fayetteville, Ark.
MORGAN, G. D. (F. '41), *Zoology*.....Denison University, Granville
MORGAN, J. W., *Chemistry*.....Wittenberg College, Springfield
MORGAN, R. G. (F. '42), *Archaeology*.....Ohio State University, Columbus 10
MORREY, C. B. (F. '20), *Bacteriology*.....317 N. Dixie Rd., South Miami, Fla.
MORSE, D. C., *Zoology*.....University of Miami, Coral Gables 34, Fla.
MORSE, W. C.....University of Mississippi, University, Miss.
MOSELEY, E. L. (F. '20), *Zoology, Botany, Physiography*,
Bowling Green State University, Bowling Green
MOYER, H. V. (F. '35), *Chemistry*.....Ohio State University, Columbus 10

MUEGEL, H. R., *Botany*.....University of Cincinnati, Cincinnati 21
MUNN, L. E., *Chemistry*.....Lake Erie College, Painesville
MYERS, R. M., *Botany*.....Denison University, Granville

NEISWANDER, C. R. (F. '32), *Zoology*.....Experiment Station, Wooster
NEISWANDER, R. B., *Entomology, Botany*.....Experiment Station, Wooster
NELSON, N., *Biochemistry*.....Armored Medical Research Lab., Ft. Knox, Ky.
NISWANDER, R. E., *Entomology*.....39 E. Ninth St., New York 3, N. Y.
NORRIS, F. H., *Botany*.....Ohio State University, Columbus 10
NORTON, B. M., *Chemistry*.....1907 North St. N. W., Washington, D. C.
NUSBAUM, C. (F. '40), *Physics*.....Case School of Applied Science, Cleveland
NYSTROM, W. C., *Education, Psychology, Sociology*.....Wittenberg College, Springfield

OBERHOLSER, H. C. (F. '21), *Zoology*.....2717 Euclid Ave., Cleveland 15
OHIO STATE UNIVERSITY LIBRARY.....Columbus 10
OLPIN, A. R., *Physics*.....310 Administration Bldg., O. S. U., Columbus 10
O'NEAL, C. E. (F. '20), *Botany*.....265 W. Fountain Ave., Delaware
ORR, G. L., *Chemistry, Physics*.....767 College Ave., Columbus
OSBORN, C. M., *Medical Science*.....Ohio State University, Columbus 10
OSBORN, H. (F. '20), *Entomology*.....Ohio State University, Columbus 10
OSBURN, R. C. (F. '20), *Ichthyology*.....Ohio State University, Columbus 10
OSWALT, E. R., *Psychology*.....761 W. Main St., Kent
OTIS, C. H. (F. '20), *Botany*.....Bowling Green State University, Bowling Green

PAGETT, OTTIS, *Entomology, Zoology, Botany*.....R. R. No. 2, Jamestown
PAPPENHAGEN, L. A. (F. '37), *Chemistry*.....705 W. State St., Alliance
PARK, J. B. (F. '30), *Agronomy*.....Ohio State University, Columbus 10
PARK, O., *Zoology*.....Northwestern University, Evanston, Ill.
PARKS, T. H. (F. '20), *Entomology*.....Ohio State University, Columbus 10
PASCHALL, A. H., *Geology*.....1823 E. Wood Place, Milwaukee, Wis.
PAULEY, M. B., *Botany, Entomology*.....517 N. Second St., Dennison
PEATTIE, R. (F. '33), *Geography*.....Ohio State University, Columbus 10
PEPPER, J. F., *Geology*.....Box 272, New Philadelphia
PERSING, E. C., *Biology*.....3316 Warrington Rd., Shaker Heights
PESKIND, A., *Medicine*.....2224 Overlook Dr., Cleveland 6
PETERSON, A. (F. '30), *Entomology*.....Ohio State University, Columbus 10
PETERSON, V. R., *Botany*.....1952 Nelawood Rd., Cleveland 12
PFISTER, M., *Engineering*.....3716 Maple Park Ave., Cincinnati 9
PHELPS, D. K., *Anatomy*.....229 W. Eighth Ave., Columbus 8
PONTIUS, L. L. *Botany*.....170 W. High St., Circleville
POOL, M. L. (F. '40), *Optics, Nuclear transmutations*.....Ohio State University, Columbus 10
POOS, F. W., *Entomology*.....3225 N. Albemarle St., Arlington, Va.
POPHAM, R. A., *Botany*.....P. O. Box 1663, Santa Fe, N. M.
PORTER, H. L., *Plant Pathology*.....Marengo
PORTER, J. P. (F. '30), *Psychology*,
The Adjutant General's Office, Technical Section, 270 Madison Ave., New York 16, N. Y.
PORTER, T. W., *Ornithology*.....411 E. Michigan St., Mt. Pleasant, Mich.
PORTER, W. P, *Botany*.....135 Grosvenor St., Athens
PRATT, D. R., *Biological Science, Natural History*.....McKinley High School, Canton 4
PRESCOTT, G. W., *Botany*.....600 Burr Oak, Albion, Mich.
PRESSEY, S. L. (F. '32), *Psychology*.....Ohio State University, Columbus 10
PRICE, J. W. (F. '32), *Zoology*.....Ohio State University, Columbus 10
PUCKETT, N. N., *Anthropology*.....Western Reserve University, Cleveland 15
PUPPEL, I. D., *Medicine*.....Ohio State University, Columbus 10
PYLE, W. R., *Physics*.....240 Fife Ave., Wilmington

RABKIN, S., *Biological and Dental Sciences*.....711 Doctors Bldg., Cincinnati
RANKIN, J. P., *Biology, Medicine*.....508 Elyria Savings & Trust Bldg., Elyria
RAY, F. E. (F. '39), *Chemistry*.....University of Cincinnati, Cincinnati 21
RECTOR, W. E., *Entomology*.....80 Chestnut St., Painesville
REED, H. E., *Botany*.....95 E. Twelfth Ave., Columbus
REED, J. F., *Botany*.....Box 78, Olmsted Falls
REESE, C. R., *Botany*.....266 E. Dunedin Rd., Columbus
REICHERT, C. V., *Zoology*.....Ohio State University, Columbus 10
REYNOLDS, R. J., *Botany, Zoology, Conservation*.....2645 Powell Ave., Columbus
REYNOLDS, W. B., *Chemistry*.....University of Cincinnati, Cincinnati 21
RHOADES, R., *Conservation*.....Stone Laboratory, Put-in-Bay
RICE, E. L. (F. '20), *Zoology*.....Ohio Wesleyan University, Delaware

RICH, J. L. (F. '39), *Geology*.....University of Cincinnati, Cincinnati 21
RIEVESCHL, G., JR. (F. '30), *Physics*.....1416 Vernier Rd., Grosse Pointe Woods 30, Mich.
RIFE, D. C. (F. '41), *Botany and Zoology*.....Ohio State University, Columbus 10
RILEY, C. L., *Biology, Botany, Geology and allied subjects*.....1226 14th N. W., Canton 3
RITTENHOUSE, G., *Geology*.....c/o W. Va. Geol. Survey, Morgantown, W. Va.
ROACH, L. S. (F. '41), *Zoology, Animal Ecology*.....Box 224, Athens
ROBINSON, J. M., *Entomology*.....Polytechnic Institute, Auburn, Ala.
RODABAUGH, J. H., *Anthropology*.....Ohio State Museum, Columbus 10
ROGERS, A. S. (F. '27), *Psychology, Biology*.....Ohio State University, Columbus 10
ROGERS, C. G. (F. '20), *Physiology*.....378 Reamer Pl., Oberlin
ROGICK, M. D., *Zoology, Anatomy, Biology*.....25 Prospect St., Apt. 1-K, New Rochelle, N. Y.
ROLLER, J., *Botany*.....7135 Chestnut St. N. W., Washington 12, D. C.
ROOD, A. N., *Botany*.....R. F. D. No. 2, Phalanx Station
ROSEBERRY, H. H., *Physics*.....229 Highland Ave., Athens
ROTHEMUND, P. (F. '36), *Medicine*.....Antioch College, Yellow Springs
ROTHERMEL, J. E., *Medicine, Zoology*.....Western College, Oxford
RUNNELS, H. A. (F. '40), *Botany*.....Experiment Station, Wooster

SALETEL, L., *Geology*.....University of Dayton, Dayton 9
SALISBURY, R. K., *Botany*.....Greenhills, Cincinnati 18
SAMPSON, H. C. (F. '20), *Botany*.....Ohio State University, Columbus 10
SANCHE, SISTER I., *Chemistry*.....College of Mt. St. Joseph-on-the-Ohio, Mt. St. Joseph
SASSAMAN, W. H., *Physics, Anthropology*.....Western Reserve University, Cleveland
SAWYER, C. W., *Medical Science*.....White Oaks Farm, Marion
SAWYER, W. C., *Medical Science*.....White Oaks Farm, Marion
SAYRE, J. D. (F. '22), *Botany*.....Experiment Station, Wooster
SCHAEFER, P. E., *Entomology*.....53 Mill Road, Durham, N. H.
SCHEAR, E. W. E. (F. '37), *Biology*.....107 W. Park, Westerville
SCHILLING, H. M., *Botany*.....Aurora
SCHMIDT, J. J., *Geology*.....East Ohio Gas Co., Cleveland
SCHRAUT, K. C., *Mathematics*.....University of Dayton, Dayton 9
SCOFIELD, H. T. (F. '43), *Botany, Bacteriology, Biochemistry*, Ohio State University, Columbus 10
SEARS, P. B. (F. '39), *Botany, Entomology*.....Oberlin College, Oberlin
SECREST, E. (F. '24), *Forestry*.....Experiment Station, Wooster
SEMANS, F. M., *Zoology*.....North Jackson
SEMMELMAN, J., *Chemistry, Botany*.....Fairview High School, Dayton
SETON, S. E., *Biological Science*.....College of Mt. St. Joseph
SEYLER, P. J., *Zoology*.....Ser. C, Station Hosp. Camp Livingston, La.
SEYMOUR, R. J. (F. '20), *Physiology*.....Ohio State University, Columbus 10
SHADLE, A. R. (F. '41), *Zoology*.....University of Buffalo, Buffalo, N. Y.
SHAFFER, P. R., *Geology*.....1510 Heyburn Bldg., Louisville, Ky.
SHANKLAND, R. S. (F. '40), *Physics*.....Case School of Applied Science, Cleveland
SHANNS, R. E., *Ecology*.....Austin Peay State College, Clarksville, Tenn.
SHATZER, C. G. (F. '20), *Geology, Geography*.....1003 Woodlawn, Springfield
SHENKER, S.....c/o Water Purification Plant, Dublin Rd., Columbus
SHEPHERST, J. M., *Forestry*.....504 River Rd., Maumee
SHERWIN, M. W., *Geology*.....1035 Riverview, Jackson, Miss.
SHETRONE, H. C. (F. '31), *Archaeology*.....Ohio State Museum, Columbus 10
SHIDELER, W. H. (F. '20), *Geology*.....Miami University, Oxford
SHIMP, B., *Psychology*.....Greenfield
SIEKERES, A., *Zoology, Physics*.....621 Foster St., Fostoria
SIGAFOOS, M. D., *Botany*.....334 W. Lane Ave., Columbus
SIGAFOOS, R. S., *Plant Ecology*.....334 W. Lane Ave., Columbus
SINNETT, R. V. (F. '41).....95 Oak Hill Ave., Delaware
SITES, J. M., *Horticulture, Taxonomy, Botany, Soils, Pathology, Ecology*,
824 Avenue F, Winter Haven, Fla.
SMITH, A. W. (F. '22), *Physics*.....Ohio State University, Columbus 10
SMITH, E. R. (F. '24), *Geology, Paleontology*.....DePauw University, Greencastle, Ind.
SMITH, G. H. (F. '32), *Geography*.....Ohio State University, Columbus 10
SMITH, H. W., *Entomology*.....Rear 196 W. Woodruff Ave., Columbus
SMITH, L. E. (F. '39), *Physics*.....Granville
SNODDY, A. O., *Chemistry*.....R. F. D. No. 6, Cincinnati 15
SNYDER, L. H. (F. '32), *Zoology*.....133 Erie Rd., Columbus
SOLBERG, A. N. (F. '41), *Genetics, Embryology, Physiology, Histology*,
University of Toledo, Toledo 6
SPANDAU, H. M., *Zoology, Botany*.....80 W. Third St., Mansfield
SPENCER, W. P. (F. '29), *Zoology*.....702 N. Beaver St., Wooster
SPERTI, G. S., *Sci. Research and Education*.....1840 Madison Rd., Cincinnati 6

SPIEKER, E. M., *Geology*.....Ohio State University, Columbus 10
SPOOR, W. A., *Zoology*.....University of Cincinnati, Cincinnati 21
SPRANG, S. G., *Archaeology*.....139 W. Eleventh Ave., Columbus 1
STAHLY, G. L., *Bacteriology*.....Ohio State University, Columbus 10
STAUFFER, C. R. (F. '20), *Geology*.....University of Minnesota, Minneapolis
STECKLE, L. C. (F. '43), *Psychology*.....Denison University, Granville
STEHR, W. C. (F. '33), *Entomology*.....Ohio University, Athens
STEIDTMANN, W. E. (F. '41), *Paleobotany, Plant Anatomy*,
Bowling Green State University, Bowling Green
STEWART, G. A. (F. '27), *Geology*.....Ohio State University, Columbus 10
STICKNEY, M. E. (F. '20), *Botany*.....Denison University, Granville
STONE, E. L., *Botany*.....2119 Marlindale Rd., Cleveland
STONE, J. F. (F. '40), *General Science*.....c/o Seagrave Co., Columbus
STOUDT, J. M., *Engineering*.....104 Wm. Howard Taft Rd., Cincinnati 19
STOUT, H. O., *Botany, Geology, Agriculture, Zoology*.....200 Eberly Ave., Bowling Green
STOUT, W. E. (F. '20), *Chemistry, Ceramics, Geology*.....154 Erie Rd., Columbus
STOVER, E. L. (F. '30), *Botany*.....Normal College, Charleston, Ill.
STRETE, R. F., *Geology*.....210 W. Iowa St., Urbana, Ill.
STRICKLER, N. H., *Botany*.....R. R. 1, Hilliards
STROHECKER, H. F., *Zoology*.....Kenyon College, Gambier
STUMM, E. C., *Geology, Paleontology*.....Oberlin
STURGEON, M. T., *Paleontology*.....Michigan State Normal College, Ypsilanti
SUMNER, C. B., *Biology, Plant Pathology, Medical Mycology*.....Kent State University, Kent
SURRARRER, T. C. (F. '41), *Zoology*.....Baldwin-Wallace College, Berea
SUTTON, T. S., *Org. and Biochemistry, Animal Nutrition*.....Ohio State University, Columbus 10
SWANSON, C. A., *Plant Physiology*.....Ohio State University, Columbus 10

TAFT, C. E. (F. '40), *Algae*.....Ohio State University, Columbus 10
TAPPAN, A. H., *Mathematics*.....Western College, Oxford
TASHIRO, S. (F. '29), *Chemistry*.....College of Medicine, Sta. E., Cincinnati 19
TAYLOR, A. M. (F. '41), *Botany, Zoology, Forestry, Horticulture*..Lake Erie College, Painesville
TAYLOR, B., *Ornithology*.....Box 22, Urbana
TEDESCHE, L. G., *Medical Sciences*.....1016 Valley Lane, Avondale, Cincinnati 29
THOMAS, E. S. (F. '37), *Ornithology*.....Ohio State Museum, Columbus 10
THOMAS, R. C. (F. '23), *Botany, Zoology, Geology*.....Experiment Station, Wooster
THORNTON, C. S., *Biology*.....Kenyon College, Gambier
THUT, H. F. (F. '34), *Botany*.....Eastern Illinois Teachers College, Charleston, Ill.
TIDD, W. M. (F. '41), *Zoology*.....Ohio State University, Columbus 10
TIFFANY, L. H. (F. '23), *Botany*.....Northwestern University, Evanston, Ill.
TILFORD, P. E.....Experiment Station, Wooster
TOBIN, K., *General Science, Biology*.....2856 Robinwood Ave., Toledo 10
TOOMEY, J. A. (F. '39), *Medical Sciences*.....City Hospital, 3395 Scranton Rd., Cleveland
TOOPS, H. A. (F. '24), *Psychology*.....Ohio State University, Columbus 10
TRANSEAU, E. N. (F. '20), *Botany*.....Ohio State University, Columbus 10
TRAUTMAN, M. B. (F. '40), *Ornithology*.....Stone Laboratory, Put-in-Bay
TUCKER, W. A. (F. '41), *Zoology, Botany*.....728 S. Remington Rd., Columbus
TURK, J. R., *Geography*.....25 College Place, Oberlin
TURNER, C. L. (F. '20), *Zoology*.....Northwestern University, Evanston, Ill.
TYTELL, A. A., *Biology, Chemistry*.....College of Medicine, Cincinnati 19

URBAN, SISTER M., *Botany, Zoology*.....444 Orange St., New Haven, Conn.
UTLEY, F. L., *Anthropology*.....165 E. Beechwold Blvd., Columbus

VAN CLEEF, E. (F. '32), *Climatology*.....Ohio State University, Columbus 10
VAN HORN, J. L., *Chemistry, Physics*.....1490 Roycroft Ave., Lakewood
VAN WORMER LIBRARY.....University of Cincinnati, Cincinnati
VENARD, C. E. (F. '41), *Zoology*.....Ohio State University, Columbus 10
VERMILLION, M. T., *Biology*.....Earich Rd., R. F. D. No. 3, Athens
VER STEEG, C. (F. '31), *Geology, Geography*.....1105 Quinby Ave., Wooster
VISSCHER, J. P. (F. '29), *Biology, Zoology, Medical Sciences*,
Western Reserve University, Cleveland
VOLK, L. E., *Conservation*.....Chatfield
VON DACH, H., *Zoology*.....Georgetown University, Washington, D. C.
VON SCHLICHTEN, O. C. (F. '29), *Geology*.....University of Cincinnati, Cincinnati 21

WAITE, F. C. (F. '20), *Anatomy*.....144 Locust St., Dover, N. H.
WALKER, C. F. (F. '41), *Ornithology*.....Stone Laboratory, Put-in-Bay
WALLACE, A. M., *Botany, Chemistry, Geology*.....Anderson College, Anderson, Ind.

WALLACE, C. W., *Physics*.....Case School of Applied Science, Cleveland
WALLER, A. E. (F. '20), *Agronomy*.....Ohio State University, Columbus 10
WARD, C., *Archaeology, Architecture and Fine Arts*.....Oberlin College, Oberlin
WAREHAM, R. T. (F. '40), *Botany*.....D. C. Heath Co., 285 Columbus Ave., Boston, Mass.
WARNER, E. N. (F. '43), *Ich., Histology*....Hdq. 461 S. T., A. A. F. Base Unit, Lamore, Calif.
WATT, L. J., *Zoology, Med. Botany*.....Western College, Oxford
WATTLE, V. J., *Chemistry*.....University of Dayton, Dayton 9
WEBER, A. R., *Engineering*.....University of Dayton, Dayton 9
WEED, R. B., *Geology*.....244 W. Gay St., Columbus
WEISHAUPT, C., *Botany*.....State Teachers College, Jacksonville, Fla.
WELLS, J. W. (F. '41), *Paleontology, Zoology*.....Ohio State University, Columbus 10
WENE, G., *Entomology*.....Comstock Hall, Cornell University, Ithaca, N. Y.
WESTGATE, L. G. (F. '20), *Geology*.....124 Oak Hill Ave., Delaware
WHITE, G. W. (F. '32), *Geology*.....Ohio State University, Columbus 10
WICKLIFF, E. L. (F. '23), *Ornithology*.....Ohio State Museum, Columbus 10
WIEBE, A. H. (F. '40), *Biology*.....T. V. A., Norris, Tenn.
WILLARD, C. J. (F. '24), *Agronomy*.....Ohio State University, Columbus 10
WILLIAMS, A. B. (F. '41), *Ecology, Ornithology, Mammalogy*.....2717 Euclid Ave., Cleveland 15
WILLIAMS, S. R. (F. '20), *Biology*.....Miami University, Oxford
WILLIAMSON, C. O. (F. '42), *Mathematics*.....College of Wooster, Wooster
WILSON, I. T. (F. '35), *Zoology*.....Heidelberg University, Tiffin
WINTER, A. R., *Biology*.....Ohio State University, Columbus 10
WITHROW, J. R. (F. '20), *Mineralogy*.....Ohio State University, Columbus 10
WITTLAKE, E. B., *Plant Pathology*.....Ohio State University, Columbus 10
WOLFE, C. C., *Zoology*.....4472 Corinth Blvd., Dayton 10
WOLFE, J. N. (F. '40), *Botany*.....Ohio State University, Columbus 10
WOLFORD, J. J. (F. '38), *Geology*.....Miami University, Oxford
WOODLAND, D. J., *Physics, Chemistry*.....Western College, Oxford
WRIGHT, F. J. (F. '29), *Geology*.....Granville

YOUNG, H. C. (F. '26), *Botany*.....Experiment Station, Wooster
YOWELL, E. I., *Astronomy, Mathematics*.....3127 Griest Ave., Cincinnati
YUNCK, G. F., *Geology*.....Pure Oil Co., Olney, Ill.

ZWICK, K. G.....19 Garfield Place, Cincinnati 2